Photon

Issue 3

June/July 2004

http://www.nightskyobserver.com/Photon

Contents

Issue 3 June/July 2004

Editorial

Welcome to the third issue of **Photon**, the new bi-monthly astronomy magazine which aims to fill the gap left by the regular printed magazines.

My thanks go to all the contributors who took the time to send in material and photos for this issue.

Call for Submissions

With the next issue looming, I'm on the lookout for material for that issue. Material has been a bit slow in coming in for the current issue which is one of the reasons its appearance has been delayed.

Photon is written by amateurs like yourself, so if you have a topic or subject that you'd like to tell others about, please do. As I said in my first editorial, **Photon** is designed to be an international magazine. This issue sees articles from Ireland, the United Kingdom, the United States, Canada and Belgium. We'd like to see material coming in from around the globe. Two areas of interest that we haven't covered in any great detail so far are astrophotography (film and CCD) and the use of webcams in amateur astronomy. But keep the equipment reviews and how-to articles coming in as well.

Software is now a part of the amateur astronomer's arsenal of tools. Whether you simply use planetarium type programs for planning observing sessions or some of the freebie software for image processing or creating stacked CCD images, let me know what you think of them, their strengths and weaknesses and maybe how you think they can be improved. No one piece of software seems to provide everything in one package.

A Letters page would be good as well and, depending on the response, we could look at setting up a message board on the **Photon** webpage so folks don't have to wait till the next issue for an answer to a query!

Everybody has a funny story to tell about astronomy or some astronomical event they've been at, so send them in, no matter how small.

I'm always on the lookout for astro-photos to use in the magazine, so please send in your images (and include as much info as possible on what equipment was used to take the photo, exposure times, etc.) Webcam and CCD astrophotography is now a huge interest area so if you use such equipment, let me know your experiences with it and the results you've achieved (good or bad).

If you're submitting large astrophotos for consideration, they'll be scaled down to fit in the magazine (and save space) but if you want to provide a web address for the original full-size image, I'll include those with any photos used.

People love reading about other people, so why not take the time to talk about yourself or your club/society (as with the article from the Des Moines Astronomical Society in this issue).

Photon is also on the lookout for advertisers. If you would like to advertise (or know anyone who does) please contact the editor at the address below for rates.

I hope you enjoy Issue 3.

Gary Nugent
photonmag@excite.com
http://www.nightskyobserver.com

Did you Know?

As news of Sir William Herschel's astronomical discoveries spread in the 1780s, many observers were particularly fascinated that his powerful new telescopes revealed stars to be circular objects, rather than the pointy 'stars' seen by the naked eye. Herschel once found himself seated next to the notoriously awkward physicist Henry Cavendish at a formal dinner: "Is it true," Cavendish slowly asked, leaning forward, "that you see the stars round?" "Round as a button," Herschel replied. Cavendish then lapsed into a silence which lasted until the end of the meal, whereupon he leaned forward again. "Round as a button?" "Round as a button," Herschel replied with a nod. These seventeen words comprised their entire conversation.

In 1733, Chester Moor Hall discovered that a so-called "achromatic" telescope could be built by combining two types of glass inside each lens. To keep his invention a secret, Hall commissioned two lens-makers to work on different halves of his lenses. Each lensmaker turned out to be busy, however, and passed the job on to someone else. Unfortunately for Hall, each man chose the same subcontractor - and his secret was out.

The Moon and Sixpence*

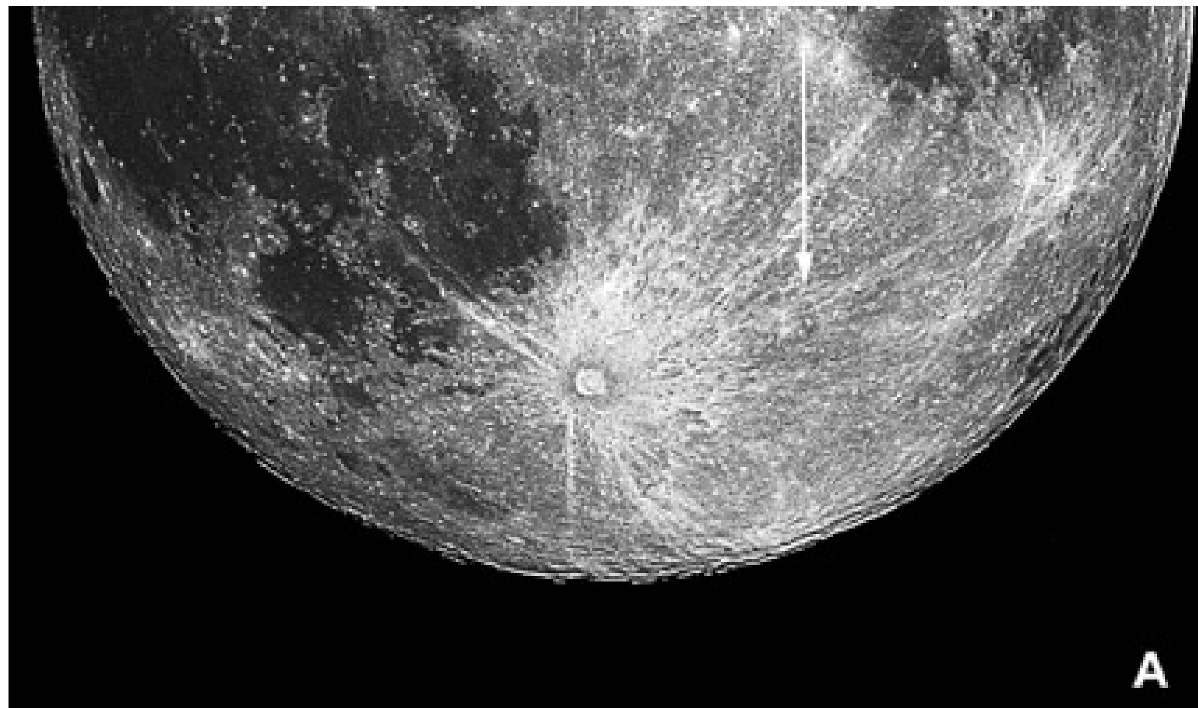
*(With apologies to W. Somerset Maugham)

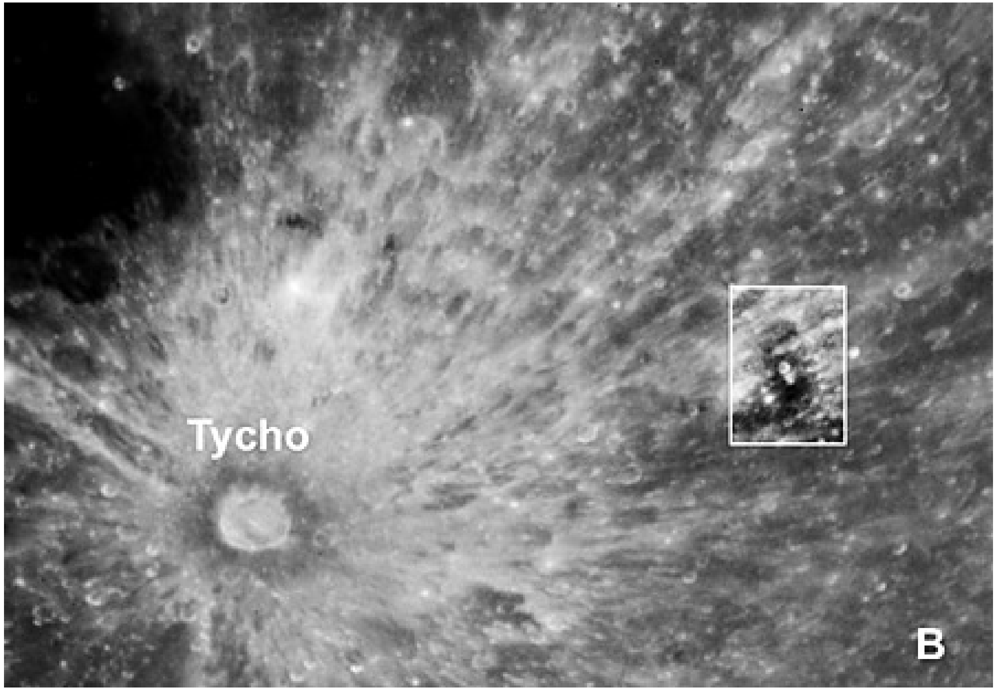
By H.J.P. Arnold

The human eye's capability of discerning patterns in detailed scenes or images (where sometimes such patterns do not exist) is well known. A recent personal instance involving the Moon and a southern hemisphere feature which, while real, took the shape of a readily recognisable Earth-bound object is a case in point.

I was testing a newly introduced black and white film to see if it had any qualities that were superior to those of films that I had used for some time. On the night in question the Moon was slightly under two days from full. It is well known that at this time the Moon is an extremely bland object bereft of the surface feature detail which is seen when the Sun is lower in the lunar sky. The desire of the photographer, therefore, is to use a high resolution film with a good tonal range and extended contrast range. With the coming of PCs, I have frequently digitised film images so that they can be manipulated using computer techniques which are easier to apply and often more successful than their purely photographic equivalents.

This was done with several frames from my test run. As I brought one of the scenes up on the monitor, I suddenly noticed what appeared to be a very clear Arabic numeral "6" appearing to the east of the dramatic ray crater Tycho. My first thought was there was a film blemish but a check showed that the object appeared on every frame. This was intriguing so I then launched a search of numerous negatives and prints that I had shot over the past couple of decades, as well as numerous illustrated books.[1] This revealed an interesting fact: the feature could be seen clearly at full Moon and for a day or so on either side of full. At other times of the lunar cycle is was not visible. Thus, the feature was something that was revealed when the solar phase angle was nearing, at, and a little after, zero – a time when surface detail is poor but when albedo differences are marked. (Here it is necessary to point out that the "6" will be a "9" for those astronomers, who place lunar south at the top of any reproduction!)





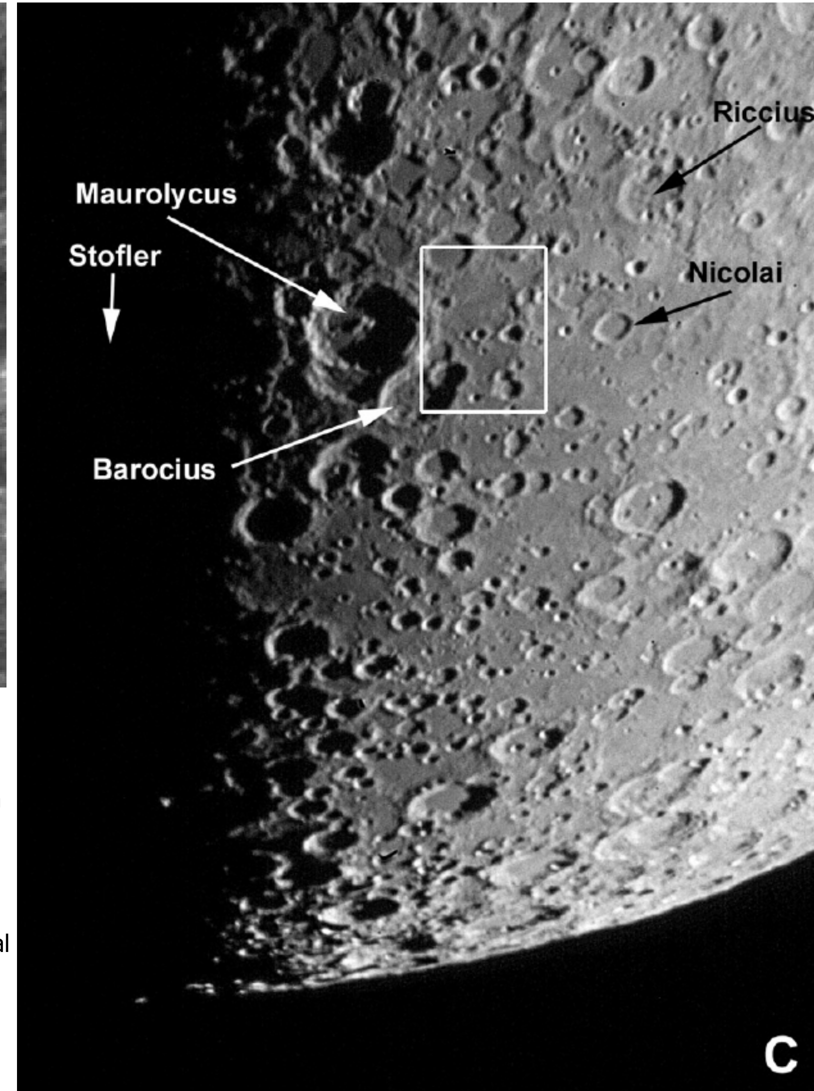
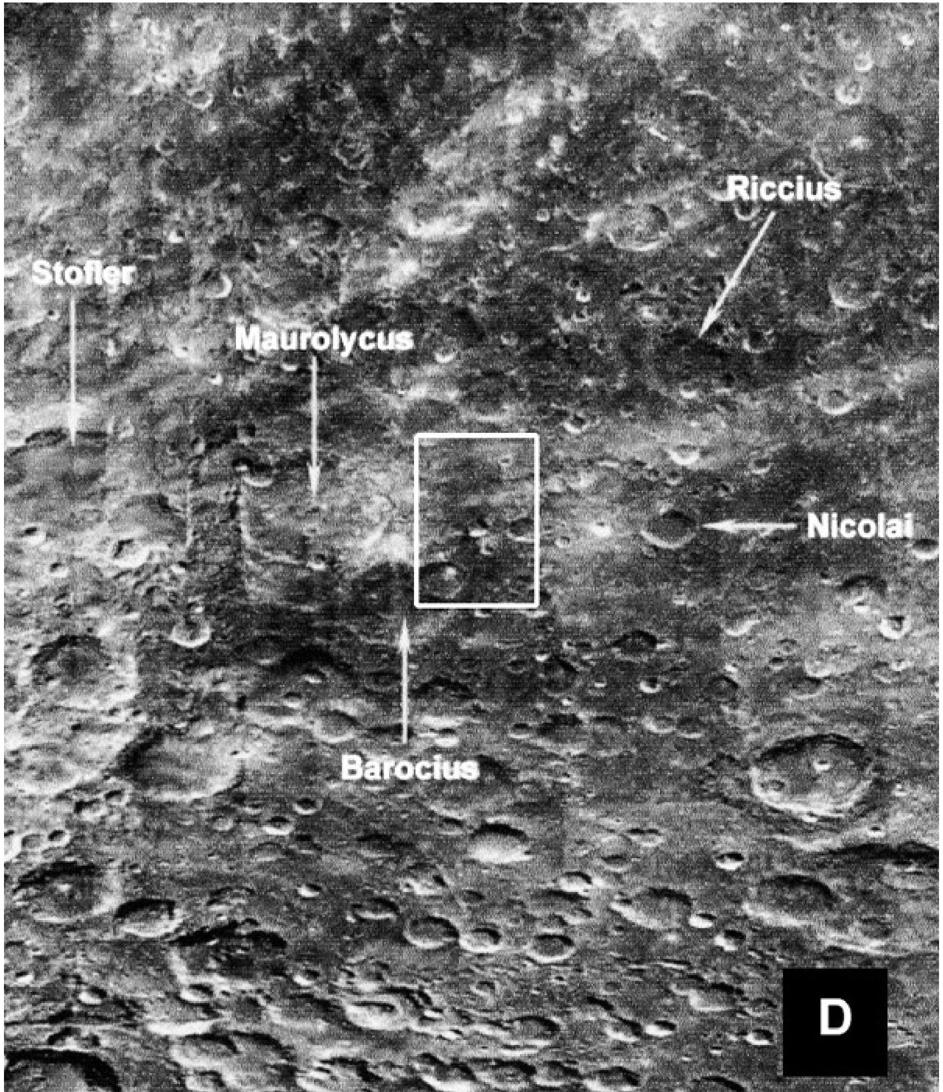
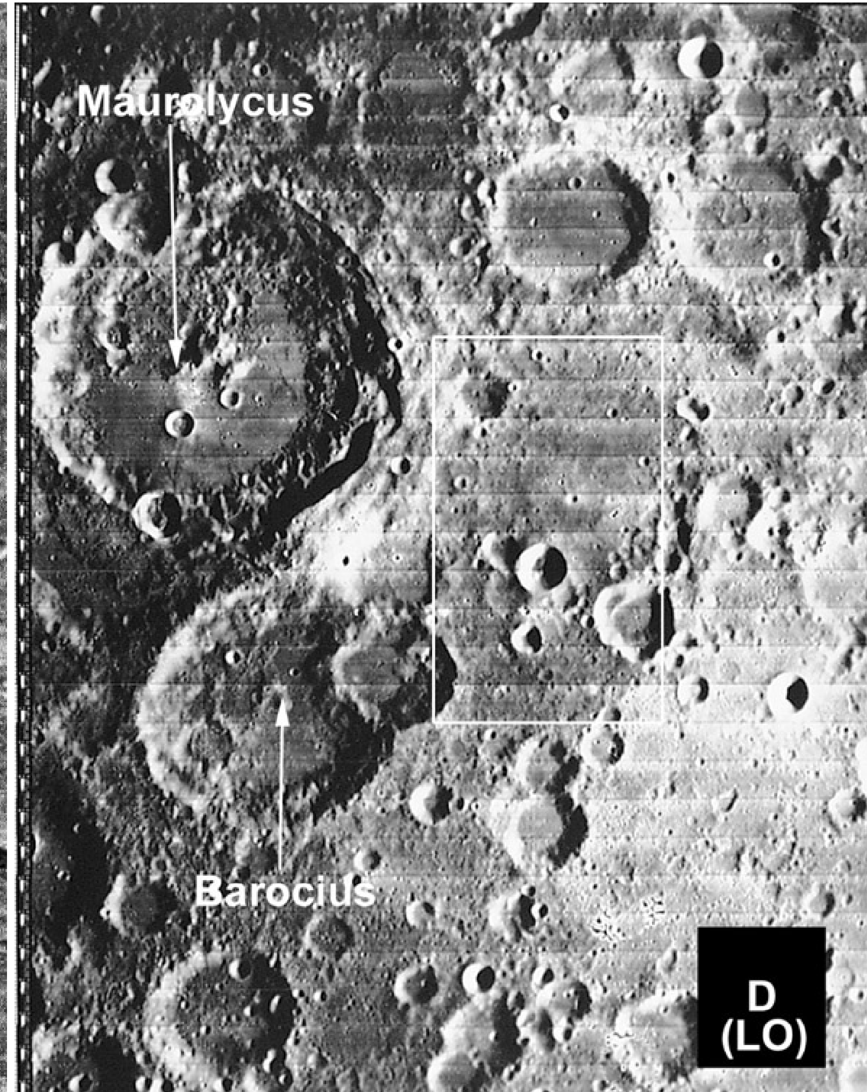


Figure A is a print of the southern hemisphere of a full Moon and is representative of many such images. The location of the feature is arrowed. Figure B is an enlargement showing Tycho and the immediate area of the feature which has been selectively enhanced. The images were taken at the prime focus of an f/9 178mm refractor. The area is dominated by the ejecta blanket and rays from the young (108 million years old) crater Tycho which is some 85 kilometres in diameter. Even images taken with very large aperture, observatory telescopes yield relatively little detail when the Moon is around full but a careful study of the location of the feature, compared with lunar maps and images taken at different solar phase angles, showed the bright curvilinear object to the west (left) to be the eastern rim of the large (114 km diameter) crater Maurolycus, described in one lunar atlas as "a vast walled plain with central peaks".[2] Figure C is a section from a frame exposed using eye piece projection (with a 26mm objective) at the refractor when the Moon was a little over 6 days old. Tycho was still in darkness at this time but the craters

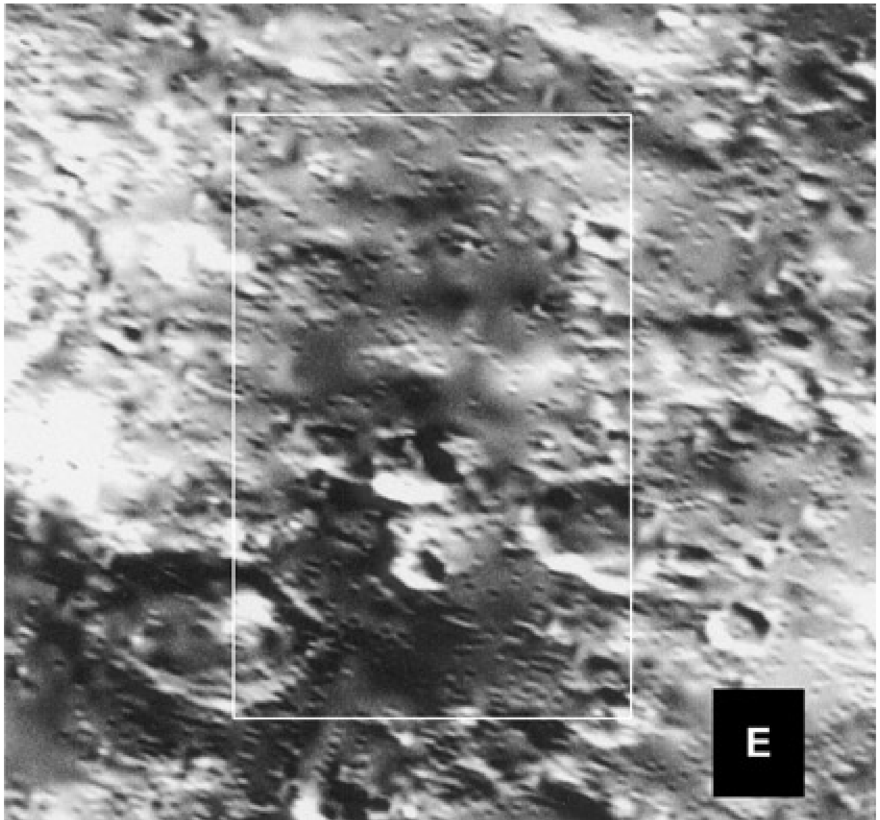

Riccius
Stofler
Maurolycus
Nicolai
Barocius
D

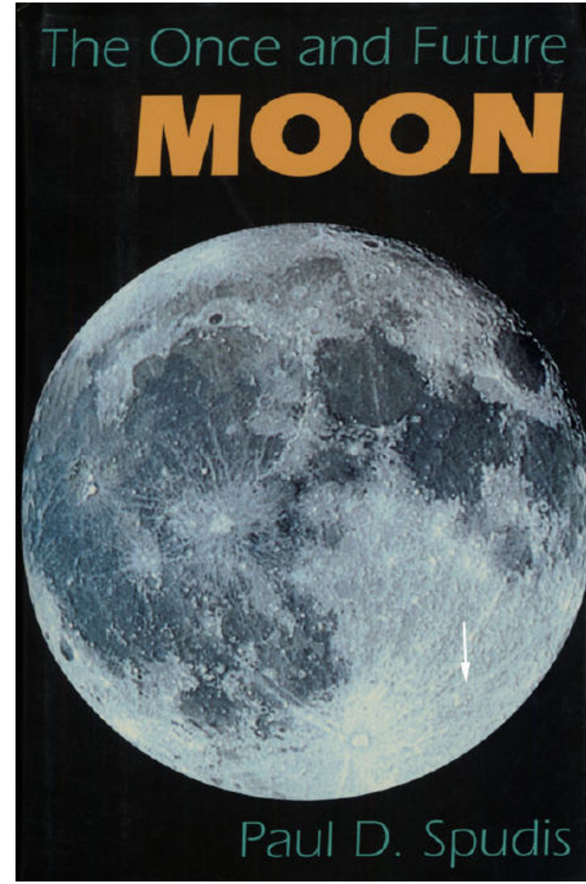

Maurolycus
Barocius
D
(LO)

around the feature, which is ringed, are named for reference. Since the Moon was far from being full in this image the feature is not visible.

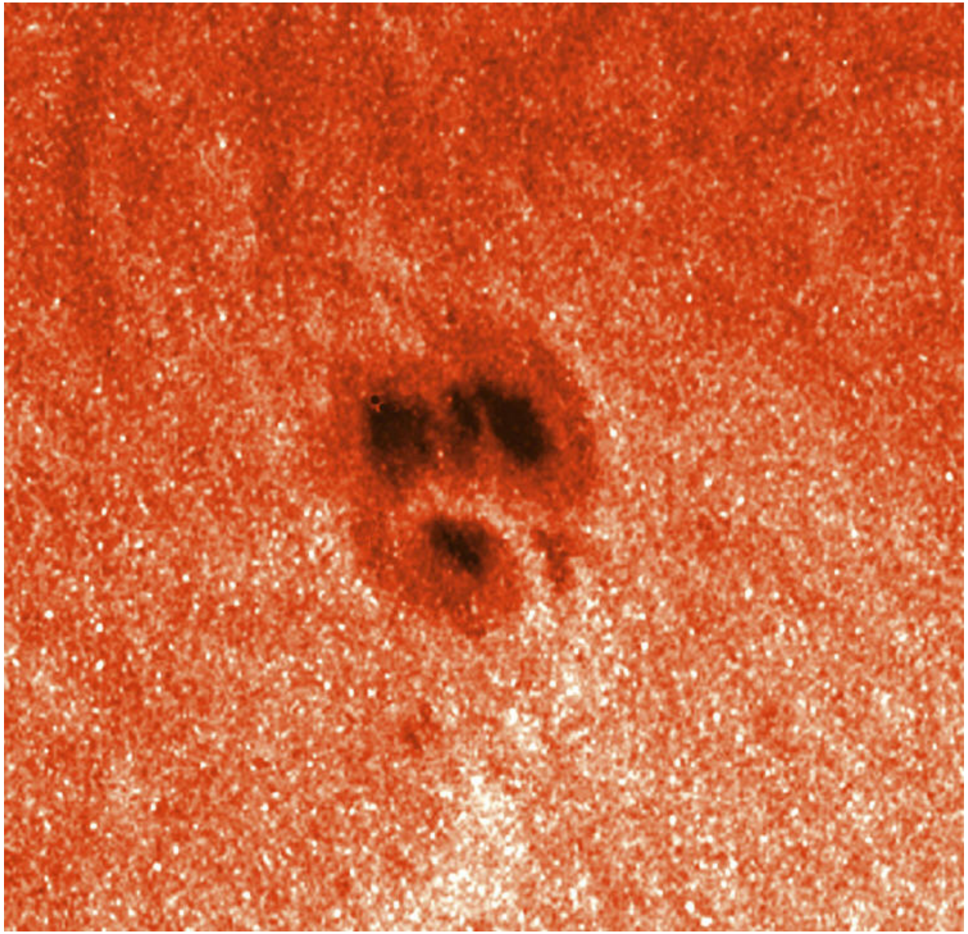
Having arrived at this stage there was a necessity to locate higher resolution images. The rich harvest of images obtained by the Clementine spacecraft in the spring of 1994 (2.5m according to deputy science team leader Paul Spudis of Houston's Lunar and Planetary Institute) was readily available since after the mission ended the data were placed on the World Wide Web at URL http://www.nrl.navy.mil/clementine. Lunar Orbiter images were also investigated at http://cass.jsc.nasa.gov/research/lunar_orbiter/.

Figure D is a section from a downloaded 415nm image taken by Clementine's UV-VIS (Ultraviolet/Visible CCD) camera of much of the area shown in (C). The same locating craters are named and the feature ringed. This image confirms a fact revealed by (A) and (B), but with greater clarity - that Maurolycus and the feature (although the latter is dark) are situated on one of the very prominent ejecta rays emanating from Tycho. Further it would appear that it is ejecta from Tycho that has rendered the eastern rim of Maurolycus so bright in most of the images. The dark "6" is readily visible in this frame. A Lunar Orbiter image (D (LO)) is of much higher resolution and shows the surrounding area extremely well but albedo differences are not so clearly shown. Finally, presented as Figure E is an extreme enlargement from the Clementine image which has also been contrast stretched. This technique emphasises differences in albedo to the east of Maurolycus. An approximate calculation indicates the feature's north-south length to be somewhat greater than the diameter of Maurolycus – perhaps about 120kms.





The surface elements resulting in the formation of the dark figure "6" are readily seen in this last print. The



A cluster of sun spots taken through a DayStar filter

and its surroundings) the figure runs in an approximate north-south direction across a wide area of ejecta ray which gives it its visibility. Further, by chance two small craters in close proximity have a higher albedo and create the appearance of the centre of the lower "o" of the figure. Off to the north, light material extending from the east runs westwards just far enough to create the upper part of the figure but not so far as to breach the dark regolith which appears to form the upper left curve of the figure. Its upper right curve is formed partly by the fortuitous distribution of darker and lighter albedo material but also by what may well be a ridge or

area generally is a somewhat chaotic mixture of dark maria material and much lighter material presumably ejected when Tycho was formed. While there are numerous dark patches (for example, the crater Barocius

old crater rim – which is incidentally shown in Map XVII in Edmund Neison's classic book *The Moon* published over 120 years ago![3]

At a time when many seek extra-terrestrial explanations for apparent anomalies on Earth and elsewhere it is necessary to emphasise that at no time did I think that the figure was other than a chance feature observed on the lunar surface at a particular phase angle of the Sun. The intriguing puzzle for me personally is why I didn't notice the "6" on numerous other full Moon images taken over the years. I am even now looking again at the dust jacket of Paul Spudis' book *The Once and Future Moon*: there is the full Moon in colour and, despite the slight loss of quality resulting from reproduction techniques, the "6" east of Tycho is clearly visible. Readers are invited to make the same test of any reasonable quality picture of a Full Moon!

Postscript

The Sun is not to be outshone by the Moon when it comes to phenomena exercising the pattern recognition capabilities of the human brain. At left is an image exposed through a DayStar hydrogen alpha filter. The seeing was not good at the time and the resulting lack of fine detail contributed significantly to a cluster of Sun spots appearing very much like - the face of a dog.

I am grateful to Patrick Moore, Paul Lowman (NASA Goddard Space Flight Centre) and Paul Spudis (Lunar and Planetary Institute) for information and discussion.

See for example plates X,XI,XII and CLIV in *Photographic Atlas of the Moon*, Zdenek Kopal, Academic Press, 1965.

Atlas of the Moon, Antonín Rükl, Hamlyn, 1990. Longmans, Green, 1876. Also shown in Map 66 of Rükl, op cit.

INSUFFICIENT DATA SYNDROME?

by J.C. Vickers

I have an insatiable appetite for visible deep space objects… been this way ever since I can remember, so the debility goes unlamented by myself and family.

Lately, I find there are treatments for my condition. One can now go online, search, and acquire enormous, if still insufficient, amounts of information on any class of deep-space object. Let me share some details with you, in case you're like me, suffering needlessly, unapprised of recent developments. Note that these remedies are only temporary. I mean, you can soak up every available scrap of data on NGC 4594 (M104), for instance— primary galaxy of the Virgo Supercluster, an object that has awed me since first seeing a poster of a Palomar image as a child: gigantic with way over a trillion suns, thousands of globular clusters, that immense rim of dust and gas. Imagine the potential there. How many times I have imaged that object! You think you know something about the Sombrero; then, quite rudely a new Hubble image pops up, as in a recent *Astronomy* issue. Gott im Himmel— I had no idea! But I digress, as I am wont.

Treatment Facilities— for acute conditions, let's get right to them:

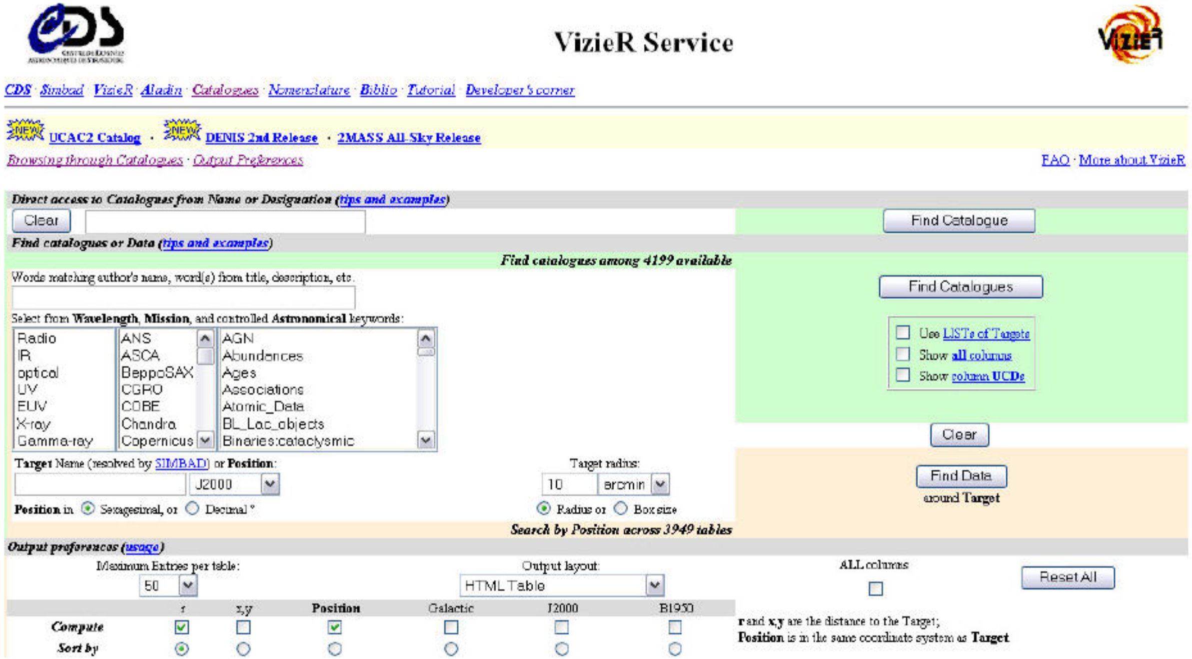
For extra-galactic object information visit Doctor "NED", the NASA Extragalactic Database, at http://nedwww.ipac.caltech.edu/. At NED there are myriad possibilities for looking up what you plan to find. Beware, the site is like a dictionary, it's easy to get sidetracked down interesting lanes.

Also helpful: NASA Astronomical Data Center (ADC), at http://adc.gsfc.nasa.gov/

For inter- and extra-galactic deep-sky objects, and for catalogs travel to: Centre de Données Strasbourg (CDS), at
http://cdsweb.u-strasbg.fr/cats/Cats.htx ; or,
http://vizier.u-strasbg.fr/cgi-bin/VizieR ; or,
http://leda.univ-lyon1.fr/search.html

On arrival, have your object list or catalog titles (or reference numbers) ready.

Astronomical data websites, have at least two main options: Option one, simply "query" the website facility individually for specific objects of interest. What you get is a customizable, relatively easily understood array



of available data fields characterizing your entry. If stymied— there are usually very good help links to explain each parameter.

Option two is more substantial. Try following the FTP address link provided, often near webpage tops, to call up or download entire databases for future reference. This latter option entails selecting all associated files, which will teach much about that class of object, enabling you to appreciate the "machine readable" columns of data. I download items into folders of my naming; and I paste in the browser webpage address at the top of the ever present ReadMe file, to ease retracing steps. Unfamiliar terms or phrases from a catalog may be searched out and understood by pasting them into your favorite online search engine— people are amazingly generous in creating slews of explanatory websites. By the way, it may be possible for you to now import your new databases into an astronomy program for charting! So, what kind of objects are we talking about here?

Some online documentation on deep-space phenomena: Seek out these catalogs, and call me in the morning. At the CDS site, you will notice references to other available, related documents. You can search by title, author, keywords, or document #.

Planetary Nebulae:
Strasbourg-ESO Catalogue of Galactic Planetary Nebulae, Acker et al., 1992.
• Catalogue of Galactic Planetary Nebulae, Perek, L., and L. Kohoutek, Academia Publishing House of the Czechoslovak Academy of Sciences, Prague, 1967.

Diffuse Nebulae:
• Catalog of Reflection Nebulae, van den Bergh, 1966. At ADC as catalog #7021.
• Catalog of Bright Diffuse Galactic Nebulae, Cederblad S., 1946, Lund Medd. Astron. Obs. Ser. II, 119, 1, 1946; or, CDS file #VII/231.
• Catalogue of HII Regions, Sharpless S., Astrophys. J. Suppl. Ser. 4, 257, 1959; or, CDS #VII/20.

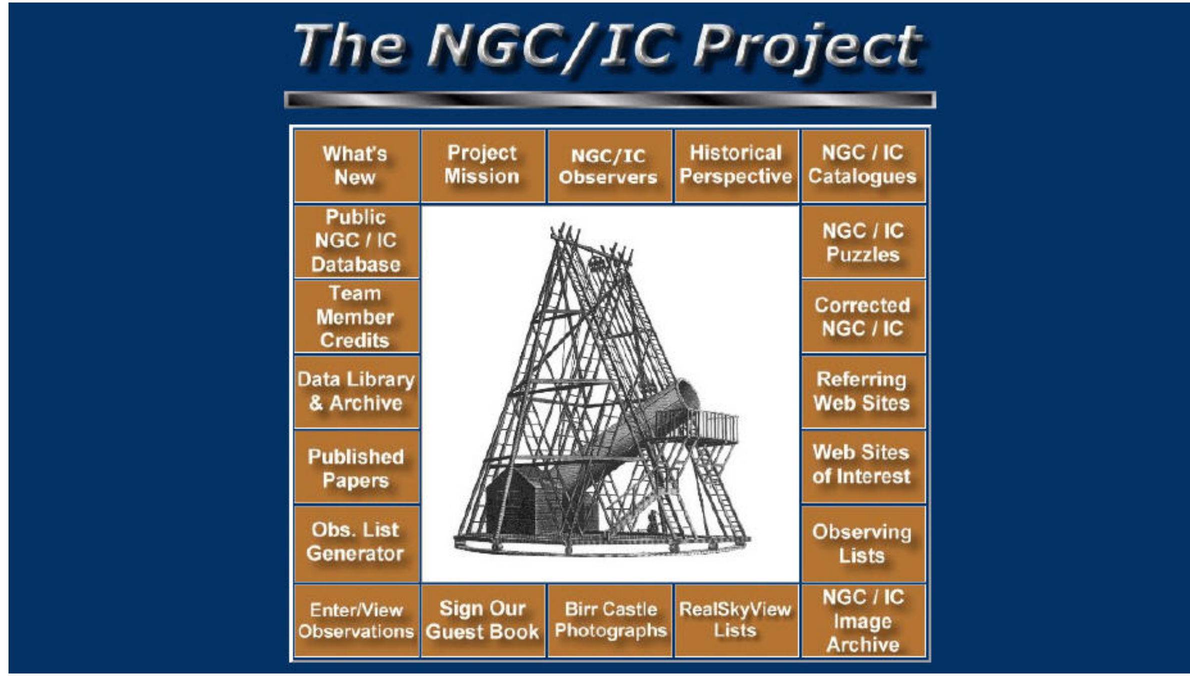
Open Clusters:
• New Catalog of Optically Visible Open Clusters and Candidates, Diaz W.S., et al. Astron. Astrophys. 389, 871, 2002; or, ftp://cdsarc.u-strasbg.fr/cats/VII/229.
• Lund Catalogue of Open Cluster Data, Fifth edition, G. Lynga, 1987; or, CDS #VII/92.
• Star Clusters/Associations. III Open Clusters, Ruprecht et al., 1983; or, CDS #VII/101A.

Globular Clusters:
• Catalogue of Star Clusters & Associations II. Globular Clusters, Ruprecht et al., 1981.
• CDS files #VII/103, #VII/44B.
• Catalog of Parameters for Milky Way Globular Clusters, Harris, W.E. 1996, AJ, 112, 1487; or, http://www.physics.mcmaster.ca/resources/globular.html
• Structure Parameters of Galactic Globular Clusters, Webbink, R.F., (from IAU Symp. 113: "Dynamics of Star Clusters", Ed. J. Goedman & P. Hut, 541, 1985); or, CDS file #VII/151.

Galaxies:
• Catalogue of Southern Peculiar Galaxies and Associa-

tions, Vol. I. Positions and Descriptions, Arp H.C., Madore B.F., Cambridge University Press, 1987; or, ftp://cdsarc.u-strasbg.fr/pub/cats/VII/170.
• Third Reference Catalogue of Bright Galaxies, de Vaucouleurs, G., A. and H. et al., Springer-Verlag, New York. 1991; or, CDS #VII/155.
• Paturel, G., et al. Catalogue of Principal Galaxies. LEDA. 2000.
• Southern Galaxy Catalogue (SGC), Corwin, H.G., de Vaucouleurs, A., de Vaucouleurs, G., The University of Texas Monographs in Astronomy No.4; or, CDS #VII/116.
• Atlas of Peculiar Galaxies, Arp, H., The Astrophysical Journal, Supplement No. 123, Vol. 14, pp. 1–20. November, 1966.
• Atlas and Catalogue of Interacting Galaxies, Part I, Vorontsov-Velyaminov, B. A., Moscow. 1959. (Part II, see: Astron. Astrophys. Suppl. 28, 1. 1977.)
• Morphological Catalogue of Galaxies, Vol. I-IV, Vorontsov-Velyaminov, B. A., et al., Moscow. 1962-1968.
• Catalogue of Galaxies and of Clusters of Galaxies (CGCG), Vol. 1-6, Zwicky, F., et al., Pasadena. 1963-68.
• Catalogue of Selected Compact Galaxies and of Post-Eruptive Galaxies, Zwicky, F., et al., Zurich, 1971.
• Eighth List of Compact Galaxies", Zwicky, F., et al., Astron. J. 80, 545. 1975.

Galaxy Clusters:
• A Catalogue of Rich Clusters of Galaxies, Abell G.O., et al., Astrophys. J. Suppl. Ser. 70, 1, 1989; or, CDS #VII/110A.
• A Catalog of Morphological Properties of the 2712 Abell Clusters, Struble M.F., et al., Astrophys. J. Suppl. Ser., 63, 555, 1987; or, CDS #VII/96.
• Data on 1889 Abell's Rich Clusters of Galaxies, Leir A.A., et al., Astrophys. J. Suppl. Ser. 34, 381, 1977; or, CDS #VII/87A.



• Catalogue of Abell and Zwicky Clusters of Galaxies, Abell G.O., Astrophys. J. Suppl. Ser. 3, 211, 1958 (and, Corwin H.G., Astron. J. 79, 1356, 1974); or, CDS #VII/4A.
• Edinburgh-Durham Southern Galaxy Catalogue IV. The cluster catalog, Lumsden S.L., et al., Mon. Not. R. Astron. Soc. 258, 1, 1992; or, CDS #VII/175.

No list of online resources is complete without mentioning the NGC-IC Project site—
http://www.ngcic.org/

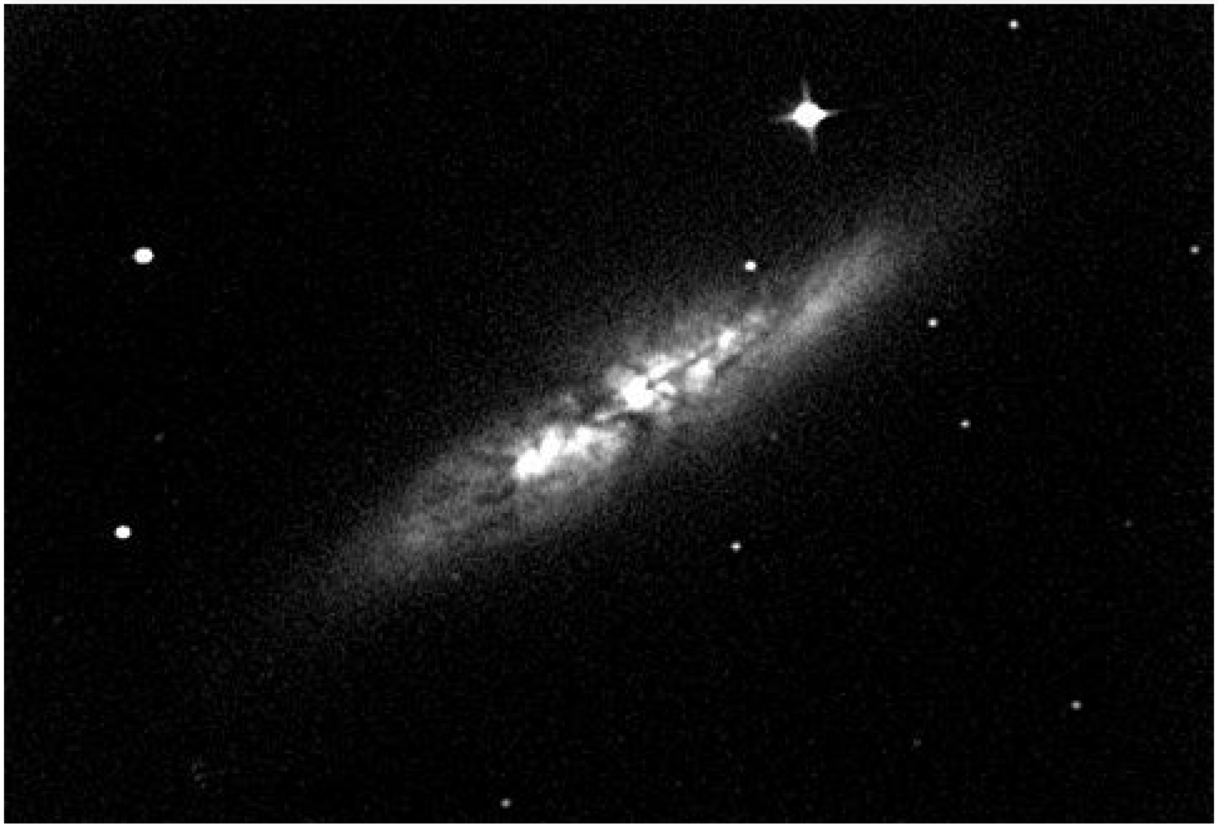
Puzzled by object prefixes?
Full catalog names can tell you a lot about items in them; I've compiled a prefix list, which is downloadable from my website. While you're there, observe my other databases which are available for general consumption (no prescription necessary)—
http://www.gis.net/~vickers/

In the final analysis, why do we suffer from data insufficiency? Part of a general condition of being human? As such, we see with our minds, let them be clear!

John Vickers is also the author of:
Deep Space CCD Atlases North & South
Which can be purchased through his website.

Adventures in CCD Imaging

By Gary Nugent



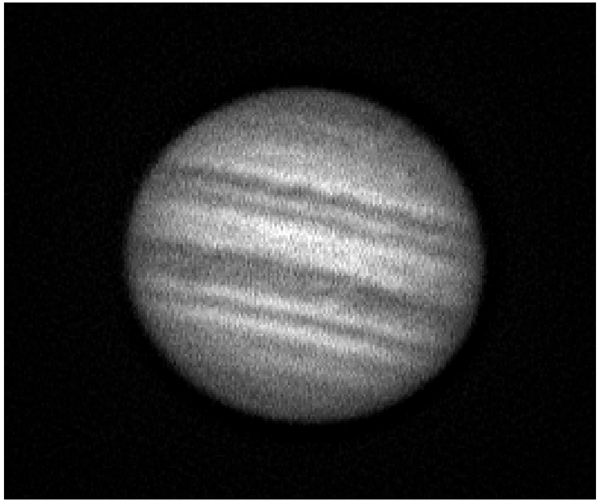
M82: Sum of three 1-min, one 2-min, two 3-min and one 5-min exposures (equivalent of 16-min exposure)

Wanting to get into CCD imaging a couple of years ago, I looked at a number of cameras that were available to the amateur astronomer. Cost was an issue, as was support should something unexpectedly go awry with the device. SBIG (the Santa Barbara Instrument Group) produce a range of cameras ranging from the ST-4 (which is now out of production due to a dwindling supply of parts) to the top of the range ST-2000XM, all of which are highly rated. The prices of the ST-4 and ST-5C were within budget. The size of the CCDs themselves were a little on the small side though. As an alternative, the cameras produced in the UK by Starlight Xpress were quite interesting. They were relatively cheap (as these devices go), had bigger CCD chips and their MX range of cameras had a unique capability which finally clinched the deal for me. With the addition of an extra module (called STAR 2000) the MX range of cameras can self guide and image at the same time.

MX516

The MX5 series of cameras are quite small and easy to use; there are three models, the MX512 greyscale 12-bit camera, the MX516 greyscale 16-bit camera and the MXSC one-shot 12-bit colour camera. All models are supplied with software for use on the MS Windows operating system. The camera therefore requires a PC for its operation and a readily available power supply. Consequently, such cameras are best suited to use in an observatory or a location with easy access to a power supply.

While the MX cameras can be run from a car battery, the manual does warn the user about running a laptop from the same battery as the camera. In my case this isn't a problem as I have mains power available in my observatory.



Jupiter, Nov.20, 2000, 20:40 UT.
Average of five 1-sec exposures

All the cameras are provided with 1.25" nosepieces for attachment to the optical train of a telescope (in place of an eyepiece). The nosepiece can be removed and standard M42 threaded camera lenses can be attached to the cameras (extension tubes are required) for wide-angle imaging.

Initial Set Up

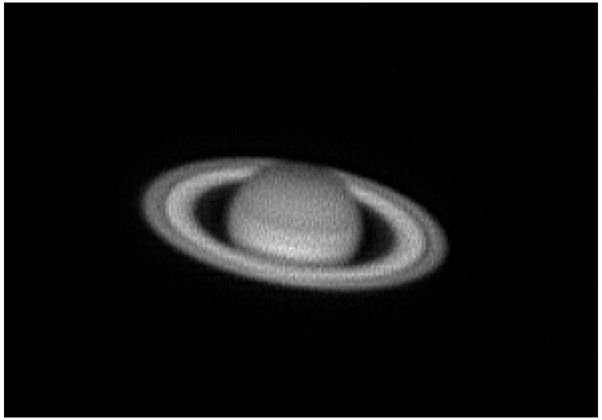
In October, 2000, I set out for my first night of CCD imaging. I learned pretty quickly that using a CCD camera is something of a challenge. Two problems instantly presented themselves: 1) getting a properly focused image and 2) centering an object on the CCD camera itself.

With a 35mm SLR attached to a telescope, you can look through the camera's viewfinder, centre the object of interest, focus the image and take the photo (all an art form in itself, as you'll know if you've ever tried it!). With a CCD camera you can do...none of the above.

The technique I had to employ was to centre an object in the field of view using a medium power eyepiece, then replace the eyepiece with the CCD camera and take an image using the software provided. I also had to refocus both the eyepiece and camera each time as their focus positions were different. The software does include a facility to help with focussing - a small window (with fast download times to the PC) can be used for seeing the effects twiddling the telescope's focus knob has on the resulting image. However, even the small amount of flexure involved with the extra weight of the camera compared to an eyepiece and slight jarring of the 'scope during the swapping process was frequently more than enough to move the object of interest off the camera's imaging area. (I didn't learn about this until I'd finally managed to achieve focus!)

Finding the initial point of focus with my camera (an MX516) was a trial and error affair. Imagine yourself in a pitch black room whose dimensions you don't know. You know there's a wall somewhere and you wave your arms about as you gingerly step through the darkness. Eventually you find it. Focusing your CCD is a bit like that the first time. Since I had no idea where the focus point was, I ended up cranking the camera along the entire length of the optical train. No stars popped into view. I got worried that maybe, just maybe, there wasn't enough back focus on my 'scope for this particular brand of CCD camera.

After further trial and error, I eventually found the camera's focus point, although it left just less than 1cm to play with in the optical train if any other devices were to be attached. Focusing with a CCD camera leaves very little latitude for error. I had completely missed the focus point earlier because I was incrementally turning the focus knob by too much each time I took an image.



Saturn, Nov. 20, 2000, 23:00UT.
Average of seven 5-sec exposures

Flip Mirror

The problems with losing an object off the CCD when the eyepiece was swapped out for the camera finally prompted me to buy a True Technology Flip Mirror. These come in two flavours - one for use with Starlight Xpress CCD cameras, the other for everything else.

With the flip mirror, the eyepiece and CCD camera could be firmly attached to the telescope as one unit. I was lucky in finding that one of my eyepieces (a 40mm eyepiece from Scopetronix) was almost parfocal with the camera. This now gave me a good starting point during my focus runs with the camera.

Focus Technique

Over the weeks, I developed a focus technique that

17-day old moon. The terminator cuts through Mare Crisium with the edges of craters Picard and Pierce A/B just being visible. Mosaic of nine 0.1 sec images

allows me to achieve focus within 5-10 minutes. I start by focussing using the parfocal eyepiece. This focus isn't perfect, so I use a 3-holed Hartmann mask to achieve better focus. If a star is out of focus, three images of it will appear close together on a picture. Focus is achieved when the three images merge into one. Even this is not enough to get pin-sharp focus with a CCD camera! The final stage of focussing uses diffraction. The secondary on my 'scope is held in place by a 4-vaned spider. I simply remove the Hartmann Mask, aim the scope at a reasonably bright star and take an image of between 30 and 60 seconds. Diffraction spikes will appear in the resulting image, and the focus is tweaked, ever so slightly, until the diffraction spikes are as long and thin as possible. Once I've done that. I know I've achieved focus.

Imaging

Long exposure CCD imaging is absolutely unforgiving of errors so, for instance, if your telescope drive is not very accurate, you'll get lots of images of star trails, even on relatively short exposures. Decent polar alignment is also a must. Even with good polar alignment, a decent drive and using PEC, your setup might not be good enough to take images for more than 30-60 seconds without trailing becoming a problem. Using a focal reducer (which I don't have) reduces the error (by making everything smaller) and can allow slightly longer exposure times. Frequently, in the popular astronomy magazines, you'll see CCD images that are comprised of thirty stacked 1-minute exposures and the like. Stacking (adding) many short exposures to emulate a single long exposure is a common technique now used by amateurs.

STAR 2000

The CCD chips employed in the MX range of cameras provide an interlaced image; first the even lines are

M51 (The Whirlpool Galaxy in Ursa Major), Mar. 16, 2002. Ten 5-minute exposures stacked. Prime focus images through a Vixen VC200L 8" reflector at f/6.3 (using a focal reducer)

exposed then the odd lines and the final picture is stitched together in much the same way as a television picture.

Starlight Xpress introduced an add-on module in 2000 for the MX cameras which capitalised on this 'feature'. Instead of imaging 100% of the time, the STAR 2000 module lets the camera image for 50% of the time (using the even lines) while it uses the other 50% (odd lines) for self-guiding (by sending impulses to the telescope drives).

What's unique about this setup is that any star in the CCD image can be used as a guide star. It saves you having to hunt around for a suitable guide star as is the case with other cameras. The downside is that you have to expose for twice as long.

STAR 2000 works with some telescope setups almost instantly - plug it in and go. That wasn't the case with my setup, however. I spent many clear nights tweaking the drive settings and the software settings in an effort to get the thing to work. All to no avail.

I was just about to throw in the towel when, in a last ditch effort, I contacted Starlight Xpress and explained my problems. It turns out that in order for STAR 2000 to work properly, the camera has to be oriented so that its base plate is perpendicular to the telescope's RA axis. It's a pity this little nugget of information wasn't included in the manual! Once I made the change to the camera's orientation, STAR 2000 began to work. It's still a little unreliable but I am working at prime focus of an f/9 system and some of the tracking errors are due to the greatly magnified effects of atmospheric turbulence or to high thin cloud dimming the guide stars. If I used a focal reducer, the tracking would be more reliable. But, given all that, I've still managed to achieve tracked exposures of up to 5 minutes. Using the tried and trusted technique of image stacking, three such images equate to a 15-minute tracked exposure. Not bad!

You can see some of the images I've taken over the past couple of years at:

http://www.nightskyobserver.com/images.htm

Book Review

By Kevin Berwick

"Choosing and using a Schmidt Cassegrain Telescope" - a guide to commercial SCTs and Maksutovs, by Rod Mollise, Springer–Verlag, 2001, 354 pages, paperback

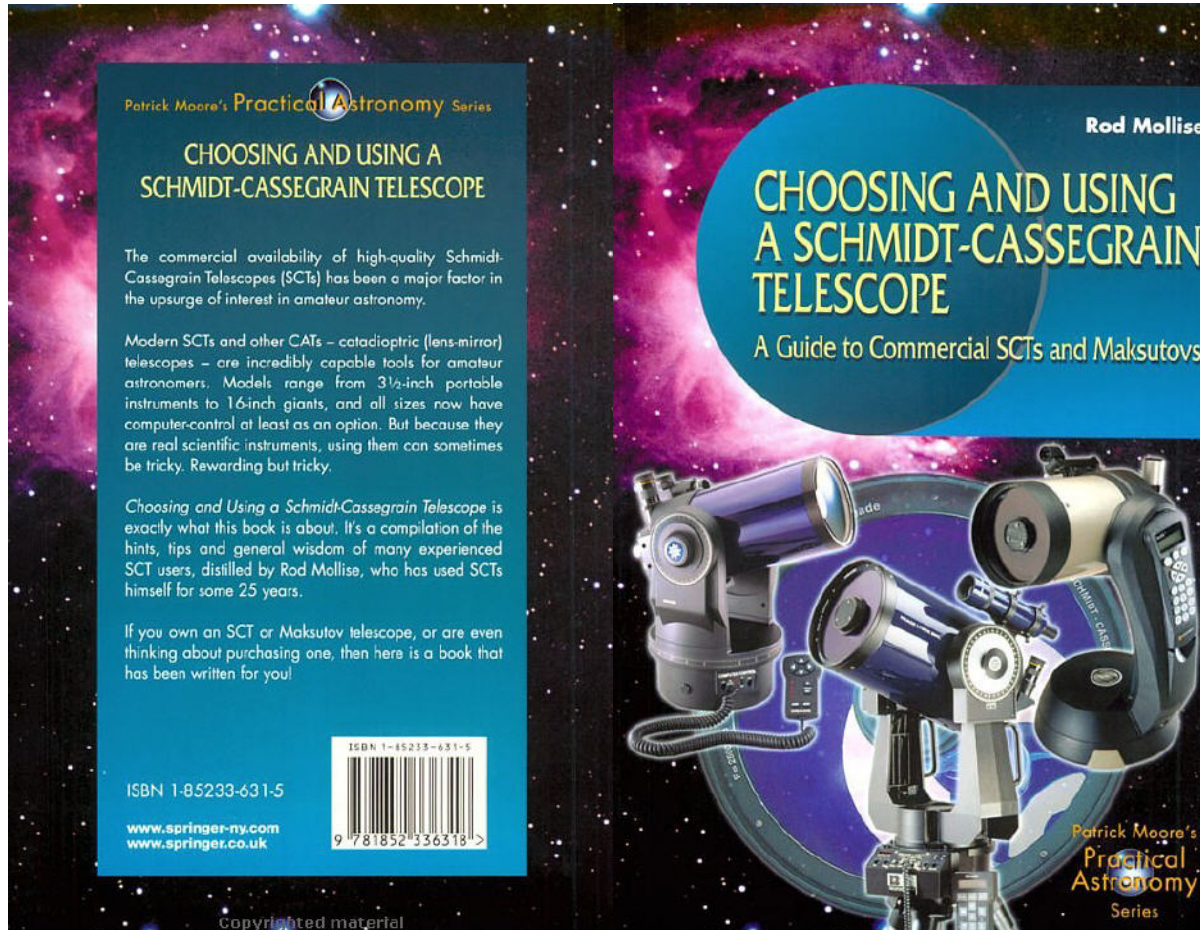
No review of this book would be complete without reference to it's author, Rod Mollise. Rod has a colossal presence on the sci.astro.amateur newsgroup. For fun, I did a search on Google's archive of newsgroups (http://www.google.com) and turned up the following awesome statistic.

Searched Groups for **rod mollise group:sci.astro.amateur**. Results **1** - **10** of about **18,100 !!!**

When not submitting articles to sci.astro.amateur he finds time to be an energetic observer and has published a couple of books on the Website of the Mobile Astronomical Society in Mobile. Both books, '*From City Lights to Deep Space!*' and '*Uncle Rod's Used SCT Buyer's Guide***!**' are available free gratis on this website and are really excellent. The former, in particular, is great if you are a suburban observer, like myself in rainy Dublin, Ireland, and are discouraged by the big magazine's concentration on observations made in Arizona or the outback of Australia. For us suburban skywatchers, it is pure distilled enthusiasm! The second book makes an excellent 'dynamic companion' to the book that is the subject of this review.

I approached this book with a bit of trepidation, since it is part of Springer-Verlag's, *Patrick Moore's Practical Astronomy Series*. I bought a couple of the other books in the series on the Internet, and was disappointed at the very uneven quality across the series when they arrived. Some are excellent, but others appear to be little more than a selection of articles slung together with little editorial input and no coherent theme. Certainly, I'd desert Amazon and head for your local bookshop for a browse before committing my hard earned cash to the other books in the series.

Rod's book is extremely comprehensive, covering eve-



rything you need to know about what must be the most popular telescope configuration on this planet - the Catadioptric or CAT.

Chapter 1, 'Why a CAT', covers the advantages and disadvantages of a CAT, plus a discussion of their capabilities. The author is a CAT enthusiast. However, I was delighted to see that this does not compromise his objectivity :- he actually has a section entitled 'An SCT may not be for you if'!! , detailing the other possibilities that you should explore if, on reflection, the Schmidt Cassegrain/Maksutov is not for you. In addition, the contrast problems inherent in this telescope configuration are frankly addressed, as is the issue of portability.

In Chapter 2,'What's a CAT?', the historical evolution of the CAT, as well as the mechanics and optics are described concisely.

Chapter 3 ,'Inside a CAT', looks more deeply into the birth of the mass-produced CAT in the 1960s, before bravely addressing the ongoing Meade vs Celestron debate, a question that generates at least a Terabyte of discussion on the Internet every year and shows no sign of resolution yet. It also includes a comprehensive discussion of the CAT tube, mount and the differences between entry level CATs and mid-level/high end models.

Chapter 4, 'Which CAT?', is a critical discussion of the features of current American and Russian CATs and offers some sound advice for those considering buying one secondhand. I particularly liked his attempt to address aperture fever when it comes to getting these scopes. The pricing of these telescopes is such that quite large increments in aperture can be had for very modest increases in price, tempting many to overreach themselves. After an initial burst of enthusiasm, they get sick of hauling out a monstrous hunk of metal and the scope gathers dust. Even a 10-inch CAT is a formidable telescope and I know of one 3 year old model which has been used only twice!!

Chapter 5 covers telescope assembly and checkout. On the face of it, you would expect much of this to be in the Instruction Manual of your CAT. Rod goes beyond the mere relaying of facts, conveying the mixture of excitement and trepidation I always feel when unpacking and assembling a new telescope. Even though I don't own a CAT, I did enjoy an hour of 'astrovoyeurism', courtesy of my reading this chapter!

Chapter 6 is a comprehensive survey of accessories for the CAT, a big chapter since the CAT must have the largest range of accessories of any telescope type. Although focussed on the CAT, much of this information is directly applicable to any telescope type. Chapter 7 covers field setup and observing. Again, much of this information is directly applicable to any telescope type and draws on the considerable experience of the author. All of the principle objects you can observe with a telescope are covered here, Lunar, Planetary and Deep Sky, together with hints and tips from a veteran observer. One nice aspect of this is that the author takes care to moderate the expectations of new observers, without sacrificing the sense of excitement about astronomy that is at the core of the book. No telescope, even a big CAT, will show you Jupiter like an image from the Voyager spacecraft. However, how about this for a quote next time you show someone the great planet through your telescope and the reaction is a disappointed 'Is that it ?'

I've been observing Jupiter for 35 years and he never ceases to amaze me. Just when you think you have seen it all something dramatic happens. The Great Red Spot fades away, belts disappear and reappear, and long-lived white spots bloom and cruise along the belts. This enormous planet, almost frightening in it's majesty, serves to show this is not a static solar system, but one that changes and lives. The most wonderful thing is that even a tiny CAT

can give you a ring-side seat for Jupiter's ever-changing and never-ending show'

If that doesn't bring them back for a second look, I don't know what will!

Chapter 8 concerns itself with maintenance, collimation, star testing and cleaning. It includes a nice checklist for diagnosing problems with your CAT and suggested remedies.

Chapter 9 is entitled, 'Keeping your CAT happy', a mix of homebrew accessories you can make for your telescope and moneysaving tips on putting simple household objects to work for your telescope. Don't fancy paying out big bucks for a telescope case....think about adapting a picnic cooler!!! Focus knob too small? You Sir, need a peanut butter jar lid!! Much of the astrowisdom I've heard is dissected, including the beneficial effects of bilberry juice on night vision and the benefits of hyperventilation at the eyepiece.

Chapter 10 is on astrophotography. It is a nice Chapter but I get the feeling that the author is, like myself, primarily a visual observer. The Chapter is reasonably comprehensive and covers emulsion and CCD, even the use of cheap security cameras for astronomical use, but I feel that the sense of excitement in the other Chapters is less obvious here.

Chapter 11 is my favourite Chapter, entitled 'Afterword: 25 years with a CAT – How to keep going'. After the largely factual content of the rest of the book, this section allows the author to explore his personal philosophy of observing and offers some insight into how he has remained a driven and enthusiastic observer for over a third of a century, 25 years of which was with a CAT. Besides making astronomy a focus of your life and prioritising it over all other pursuits he suggests setting goals, joining a Club, buying a new scope or accessory, travel and the Internet as just some of the ways of keeping the fire burning in your belly and the sense of wonder that draws us all into astronomy fresh.

I'm sure it's obvious by now that I really enjoyed this book. I highly recommend it to any aspiring or experienced observer, with no telescope or 10. The vast majority of the information in the book is applicable to any observer regardless of the scope they own. Even if you never intend buying a CAT, the freshness of approach and the incredible sense of enthusiasm will energise the most jaded telescope user.

Last, but not least, if anyone reading this has an 8 inch computerised, alt-az CAT for sale that they are willing to ship to Ireland, email me. Rod, you've done your job well!!

Astro Ignorance

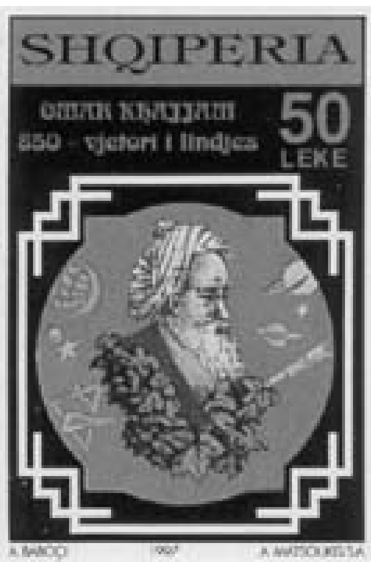
A couple years ago, at a school star party, a lady pointed to M-45 and proclaimed " There is the Little Dipper". I told her, "Maam, you are mistaken, that is the Pleiades Star cluster." She looked me up and down and replied, " Well, it must have been recently renamed." I replied, "I don't think so, it's mentioned by that name in two books of the Old Testament." She left.

- Anonymous

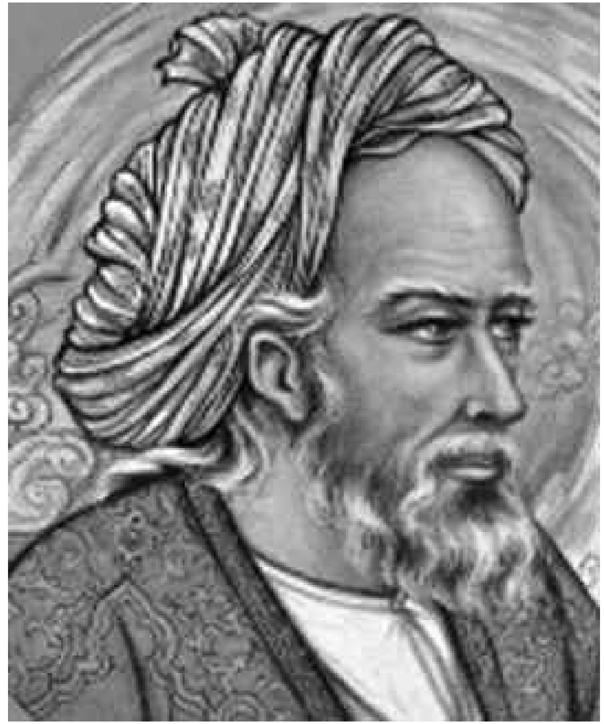
Omar Khayyam: Astronomer and Poet

By Joe Laffan

Omar Khayyam (whose Arabic name was *Ghiyath al-Din Abu'l-Fath Umar ibn Ibrahim Al-Nisaburi al-Khayyami*) was born in Naishapur in Northern Persia, now Iran, in the latter half of the Eleventh Century and died there in 1123. He was an astronomer, mathematician, poet and also a tentmaker. While some of his scientific work, namely astronomical tables, named Ziji-Mali kshahi, and a treatise on algebra have been published in the West, he is best known in English speaking countries through his Rubaiyat. This Rubaiyat is a poem of many quatrains translated beautifully into English by Edward Fitzgerald in 1859.



In his youth, Khayyam attended an academy headed by an illustrious Imam of great fame, and while there be-



came very friendly with two boys about the same age as himself. One of these was Hassan al Sabbah, who later became head of a Persian sect, the Ismailians, who seized a castle in mountainous country near the Caspian Sea and spread terror through the Moslem world. He was known to the Crusaders as "The Old Man of the Mountains" and it is claimed that the murderous activities of his followers led to them being named as "Assassins". The other boy, Nizam-al-Malik prospered and became Vizier of the Sultan. Later he bestowed a pension on Khayyam and, ultimately, became a victim of an assassin's dagger.

Khayyam continued with his studies and his observations. A later Sultan decided to reform the calendar and Khayyam was one of a committee of eight learned men tasked with this duty. They produced a computation called "The Falali Era" which was claimed to surpass the Julian Calendar and approach the accuracy of the Gregorian one.

Through the years, Omar Khayyam produced verse, some of which was used by Fitzgerald for his translation. Khayyam wrote of his love for wine, which at times led to his undoing. In one famous quatrain he wrote these lines which have been used by wine growers as advertisement ;

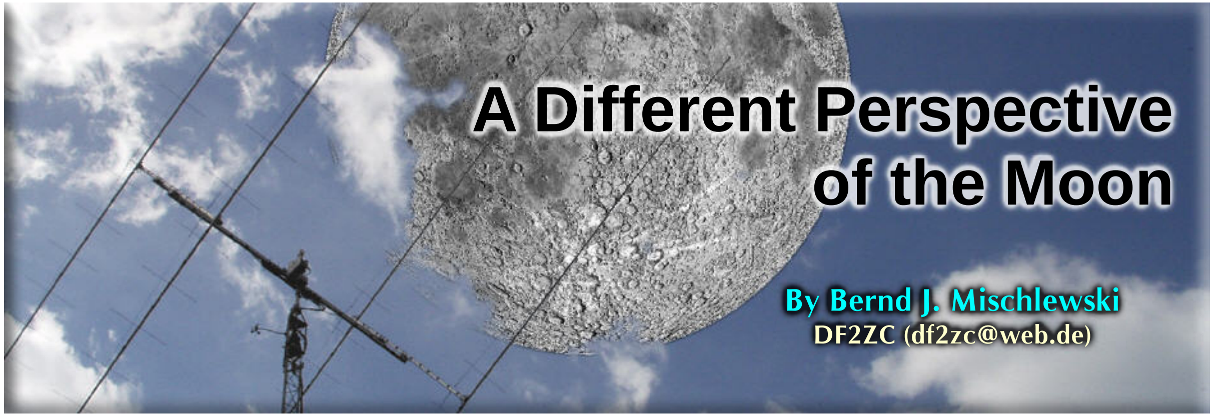
I often wonder what the Vintners buy
One half so precious as the goods they sell.

His open admiration for drinking has caused him to be regarded with disfavour by more recent Moslems. He died in Naishapur with an unrivalled reputation in science and asked that he be buried in a spot where the north wind would scatter roses over his grave, which came to pass.

The second last quatrain of the Rubaiyat, of which there are several versions, makes reference to this:

Ah Moon of my Delight who know'st no wane,
The Moon of Heav' n is rising once again,
How oft hereafter rising shall she look
Through this same garden after me, in vain.

The Rubaiyat of Omar Khayyam by Edward FitzGerald can be found online at:
http://www.therubaiyat.com/fitzindex.htm



A Different Perspective of the Moon

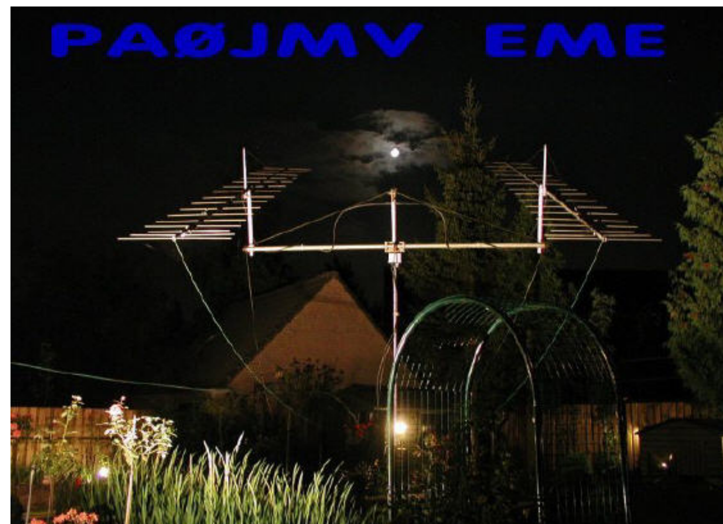
By Bernd J. Mischlewski
DF2ZC (df2zc@web.de)

Most of us watch the moon from the point of view of a hobbyist astronomer but only few know that there is also another group very much interested in lunar observations: radio amateurs or ”radio hams”. Some one-to-two million people all over the world hold a radio amateur’s license. There are frequency bands allocated exclusively for amateur radio communication by international regulations.

Each of these bands has its special propagation characteristics. Whereas on the short wave bands a piece of wire as antenna is virtually enough to communicate with the whole world, the VHF bands above about 50 MHz show a completely different behaviour. Theoretically, it is only the line of sight, that is some 20 – 50 km, which can be bridged with radio transmissions. But there are some exceptions and the biggest exception is using the moon as reflector.

So the small group of radio hams concentrating on “EME” (Earth-Moon-Earth) or “Moon Bounce” propagation use the property of the moon to not only reflect visual radio waves (the sun-light) but also normal radio signals. As the signals need to travel twice the Earth-moon distance (on average some 770,000 km) and as the moon is not at all a good reflector (it reflects only some 7% of the radiation) such as a mirror, the signal strength is very low. Generally, it is not much above the receiver noise. Often the signals even only rise occasionally from the noise for brief periods. Consequently, huge antennas are needed to cope with this. Most stations use two or four combined 6 - 10 m long yagi-antennas, an antenna type similar to the well-known TV antennas on the roofs. And the so-called “big guns” even have antenna farms of 16 or 32 of such yagis.

When trying to establish a contact, both stations of course need to see the moon. Moon tracking programs such as LunarPhase help where to direct the antenna group vertically and horizontally. EME communication isn’t quite like a normal talk. Firstly contacts are nearly always made in telegraphy. This old-fashioned modulation still has its unbeatable advantages with very weak signals. And secondly because of the special operating procedure which has been developed due to the nature of this propagation: Both stations only exchange call signs and a signal report and confirmation codes. If this data has been copied at both ends only then the contact counts as a complete one.



Even with two antennas EME is possible. Joop Mutter, PA0JMV, in the Netherlands proves this

Quite often a EME test results in a not complete or even NIL (nothing copied at all) contact because there are many parameters influencing the signal strength. The sheer difference in distance between apogee and perigee can already have a big influence. But also phase shifts of the signal’s polarization when traveling through the atmosphere can mean the difference between

Four 11 m long yagis for 144 MHz at the authors site near Boon, Germany

good copy and no signal received. Sometimes even one-way propagation is possible: Only one station copies the other. Background radiation of the cosmos which varies during each sidereal month depending in what part of the sky the moon stands is another factor that contributes to probability of a complete contact. At new moon and when the moon is very close to the sun no EME contacts are possible because the strong sun radiation ("sun noise") covers every weak signal. So the best time for EME is when the moon is at perigee and in front of a quite part of space.

So why do people put so much effort if a contact via a short wave band, a phone call or chat with the partner via Internet would be a lot easier? Well, this question is of the same type like why do people travel by bicycle if driving by car would be much more convenient. It's the challenge of establishing contacts that are hard to make and it's the thrill of copying one's own echoes off the moon: Yes, EME stations can hear themselves. Because a radio signal travels 300,000 km/s it needs about 2.5 seconds from Earth to moon and back. So 2.5 seconds after one stopped transmitting one can still receive the own echoes. And it is the technical challenge because once one started EME one would never ever stop thinking how the transmitting/receiving system could be improved.

Only recently a new EME era began. Joe Taylor, K1JT, professor at Princeton University and holder of the Nobel Prize in physics - and radio amateur - developed WSJT. It is a computer program for VHF/UHF communication using state of the art digital techniques. It can decode signals 10 to 100 times weaker than those required for conventional telegraphy. With this software now even stations with a single antenna can now work EME. This doesn't mean EME contacts have become easier in general. No, the number of stations technically capable of participating in this propagation has become much bigger. So there's another thrill: what is the smallest station I can now work via moon.

Those who would like to learn more about amateur radio are referred to http://www.arrl.org/hamradio.html on the website of the American Radio Relay League. A very good introduction to EME by Bob Kocisko, K6PF, is on http://www.gm4jjj.co.uk/K6PF/k6pf.pdf

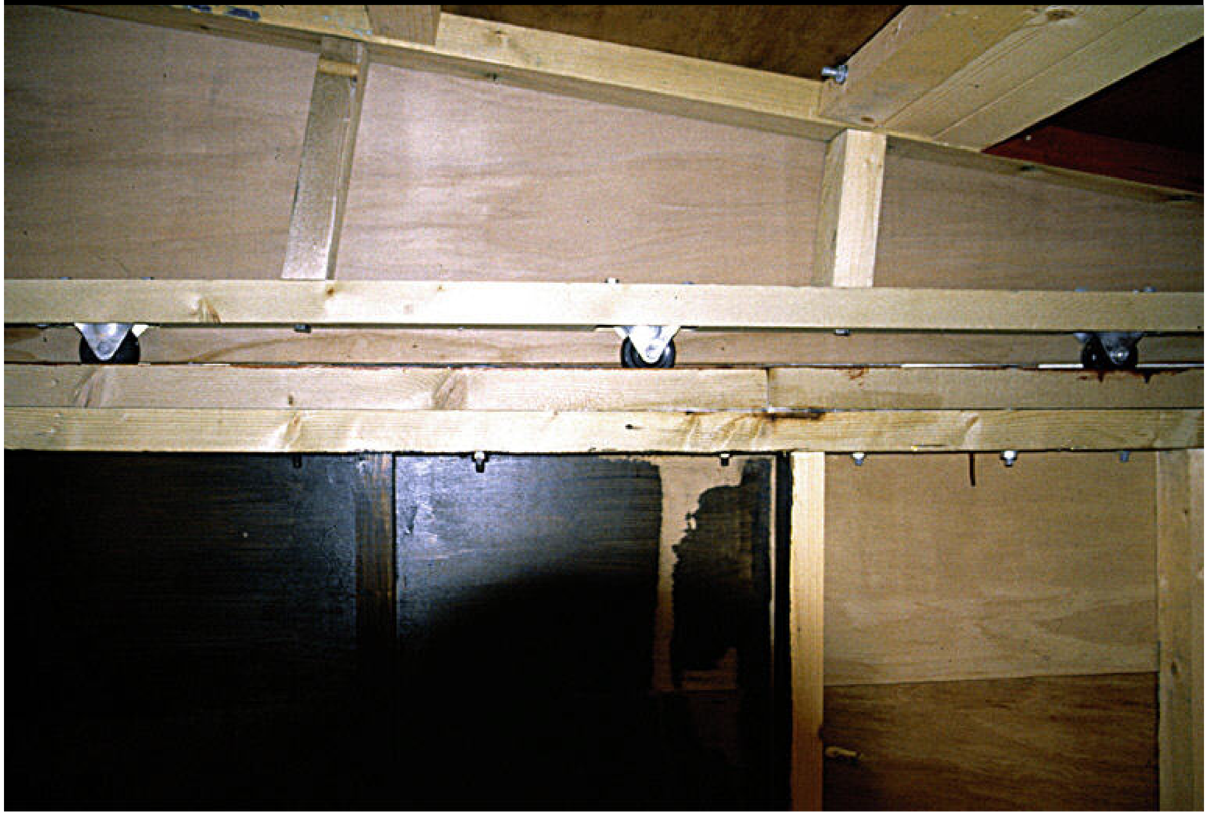
Not to forget, many of the radio hams concentrating in EME propagation are also very interested in astronomy…not surprisingly.

Dave Blaschke, W5UN, in Texas owns the biggest 144 MHz amateur radio EME antenna in the world. It consists of 32 10m long yagis

Building Your Own Observatory III

(or maybe that should be how NOT to build your own observatory...)

By Gary Nugent



The wheels running in the rails

The Roof

The roof is basically made of two triangular side pieces separated on the "top" side by five 2"x3" cross-beams. Two other beams, one each between the other apexes of the triangles, were added to make the structure more rigid.

Four wheels were positioned and marked on the bottom side of each triangle. 1-inch deep recesses were then cut into the beams, with a router, so that the aluminium wheel frames would sit into them (a router makes cutting such recesses to the same depth very easy). This meant the roof would ride a little less high off the basic observatory structure than would otherwise be the case. Combined with the grooves cut into the roof rails, the bottom of the roof now rides just over half an inch above the rails.

The wheels were then bolted into place and the basic roof frame was manhandled into position at the end of the rails. Standing upright, with the wheels facing the observatory, the roof-frame was lifted and tilted until the wheels settled into the rail grooves. This would be the first real test of the wheel-in-groove design and of the accuracy in my measurements.

For the most part, the test was successful. The roof ran relatively smoothly the length of the rails, but the wheels did have a tendency to stick when being rolled from over the observatory proper into the "rolled off" position. Evidently, the rails weren't exactly parallel. A quick check by eye showed that the wheels were rubbing against the outer edges of the grooves, so the rails were converging slightly. Some minor work with the router widened the grooves at the appropriate positions.

With the roof frame in position, plywood was cut to fit

on top of the frame and around the edges of the roof. A 3" overhang was left all the way round for water run-off. Some help was drafted in to help with laying the roofing felt. This was a real test of the entire observatory's structural strength as it had to support two (slightly) overweight men during this phase. I wasn't sure if the whole thing would take our weight or collapse like a house of cards beneath us. We need not have worried. The structure was sound (something of a pleasant surprise to me!)

The weight of the roof was increased quite considerably by the addition of the plywood, nails and roofing felt. I was concerned that one person alone would not be able to roll the roof off or, indeed, back again. This was something I just had to have faith in since I didn't do any calculations on the roof's eventual weight or how much load would need to be brought to bear to get it moving (well, who would?...except, maybe, a professional builder?)

Anyhow, my luck was in, and I could just about move the roof using just one hand. Since I didn't want any old passing opportunist to come along, just roll off the roof and nick any equipment inside the observatory, I needed some way to lock the roof in its closed position. I though about various locks, levers and bolts, but the simplest solution was to use two G-clamps (one either side of the observatory on the inside) to clamp the roof to the rails. It's surprisingly effective!

The almost finished observatory - most of the cladding is in place and one wall has been stained with a redwood wood preservative

Finishing Touches

With construction basically finished, there was one slight problem – the observatory leaked like a sieve. And the wind howled through the gaps between the roof and the observatory base.

Pine cladding was nailed in position around the outside of the observatory and the roof. The cladding was also placed on the door, hiding the hinges from view and preventing them from being unscrewed. Two wooden strips were then added to the rolling sides of the roof. These hung just outside the observatory walls so as they would not impede movement of the roof but would prevent the wind and rain from blowing through the roof-wall gap

I waited for the next rainstorm to arrive. Typically, I didn't have long to wait. The observatory still leaked, not as badly but there were definitely some precise areas of water entry. What I found was happening was that water was running along the grooves from outside (where they were collecting rain) and trickling down the joints where the roof rails met at the top of the observatory walls. Drilling a few drainage holes

The roof (before the cladding was added) in its rolled-off position. East is to the right of the picture

through the outside sections of the rails cured that problem, but the observatory still leaked.

This time the cause was rainwater running down the grooves formed by the tongue-in-groove cladding on the roof. The water actually ran behind the wind-breaking wooden strips and dripped onto the joins between the inner plywood and outer cladding on the lower observatory walls.

Out came the silicone sealant. Every join and joint received a liberal application. A thick strip was also placed behind both wind-break strips to prevent water dripping in that way.

The next rainstorm came and the observatory was…dry. Success at last! That is, until the next time I entered the observatory (a few days later), I noticed dark splotches covered all the exposed plywood surfaces. Fungus!

A trip to the local hardware shop resulted in some **Cuprinol 5 Star Complete Wood Treatment** which is used to impregnate the wood and act as a fungus killer. I liberally applied this to one section of an inner wall, as per instructed, painting on four coats. While it was well ventilated when painted on (the roof was rolled off at the time), the fumes coming off it persisted for days. I found another unsettling side effect. An eyepiece I had left uncapped developed a thin oily film on its exposed lens. I tried various lens tissues and even a LensPen, but nothing would remove the film; all just seemed to smear it. The eyepiece has not been the same since. The culprit (besides my own stupidity) was the fumes from the wood preservative. I didn't use it again. I ended up wiping as much excess as I could from the affected panel and drying it with an electric paint stripper (something like a cross between a ray-gun and a hairdryer).

After that, I painted everything inside the observatory with the same redwood preservative paint I used on the outside. Some old linoleum was put on the floor to deaden noise late at night and provide a small amount of protection for dropped eyepieces and the like.

A small worktable was finally added for charts, books and a laptop computer when used.

Other Problems

When the roof is rolled off, I leave it so that there's about 18" still over the observatory, This provides a measure of protection from the elements – this is where the worktable and electrical connections lie – especially when I'm using a laptop computer that could be sensitive to due build-up (can anyone say "short-circuit"?). The roof slopes into the observatory, howev-

er. It was designed this way so that the it wouldn't block the telescope from looking east. But this does mean that water condensing out of the atmosphere onto the roof, provides a slow, but steady, trickle into the observatory all along the width on the roof. To cure this problem, the roofing felt was lifted at this end of the roof, a 0.5" square strip of wood was placed along the width of the roof (the strip tapers downwards at the edges of the roof) and the roofing felt placed back in position. The net effect is that there is now a lip on the bottom edge of the roof that traps runoff water and directs it safely off the sides of the roof into the garden.

Squeaky Door: Damp conditions on Winter nights tend to make wood swell slightly. The outcome of this was that while the observatory door was relatively silent to open at the beginning of an observing session, it sounded like something from a bad horror movie at the end of the night. Not something appreciated by the neighbours. This was cured by sanding the saddle board beneath the door and liberally rubbing candle wax into it. Viola, a silent door.

Squeaky Rails: The rails began to suffer the same problem as the door as Winter wore on. Opening the roof was, again, relatively silent, but the noise coming from the closing roof made me think of a hyperactive clown doing a balloon animal act. Once again, candle wax was pressed into service and the clown had to find another venue.

Conclusion

Despite having limited woodworking skills and no real experience of building, this project, designed from the ground up, was completed in 12-14 weekends (about 3 months). The hurdles I had to overcome were all pretty minor and, had I been more experienced, I could have forestalled their introduction.

I now have a fully working observatory which allows me to pop out and almost immediately start observing when there's a clear patch of sky. It's also a boon where astrophotography and CCD imaging are concerned. As the saying goes...If I can do it, anybody can!

In conclusion, I'd like to give my thanks to Tim Carr, Michael Carroll and Brian Keane who all lent a hand during various phases of construction.

Astro Ignorance

We had a group of creationists come up to the club observatory to look through the big scope. One creationist was looking through a fellow's AP Traveler and started asking questions about the object in view and the universe. The fellow with the Traveler answered his questions and then the creationist said, "but is is all only theory" and kept pushing his point.

- Anonymous

An amateur was showing some members of the public some of the brighter objects in the sky through his telescope. After looking at Jupiter and its moons, he was asked: "So how many moons does the earth have ??"

- Anonymous

In 1977. several members of the Des Moines Astronomical Society (DMAS) got together to donate $50, $100 or more dollars each in order to acquire and build a 16-inch telescope. Dan Archer, then President of the club, organized the effort. The mirror was ordered in December 1977 and was delivered in June 1978. The Mirror cell, secondary holder, spider and focuser were ordered from Kenneth Novak & Co. Plywood and a cardboard "Sonotube" was purchased and plans laid out from a simple and relatively new design created by John Dobson (later to become known as the Dobsonian) for building an inexpensive alt-azimuth mounting. During the Summer months, the telescope was constructed at the home of Don Archer. First light came a couple of months later.

The instrument was used dozens of times from remote locations away from the city. Time, effort and lack of a way to easily move the telescope took its toll on the instrument. A more permanent location and mounting was needed, and DMAS President Ken Lund and others acquired funding from the J.J. Wilkie Charitable Trust. Over a period of four years, $1500 in 1981, $1400 in 1982, $1200 in 1983 and $1000 in 1985, came from the trust, totalling $5100. Parts began to be purchased for the reassembly of a more permanent telescope. A mounting was purchased from Astro-Works, and fork arms from the old 24-inch at Ficke Observatory were rebuilt. A fiberglass tube from Parks, and a new focuser rounded the major components.

In the summer of 1981, the Des Moines Center of Science and Industry offered a home for the telescope on the roof of the building. Members however opted to locate the telescope at a remote location. Star Parties started being held at a location that member Mark Albert had discovered in the northwestern corner of Jasper county, at the Ashton-Wildwood Park. President Steve Sherrod began talking with Dennis Black at the Jasper County Conservation Board about the possibility of establishing a permanent observatory at the site. The proposal was greeted with open arms, and 4 members of the DMAS met at the site with members of the Jasper County Conservation Board to determine the future observatory's location at the Ashton-Wildwood park.

Members of the DMAS submitted various designs for tile observatory. After a few months, a simple design was agreed upon by the newly established observatory committee which was made up of Stephen Sherrod, Larry Stevens, Jim Leasure and Gary Cameron, with dratiing and design assistance from Connie Allen. The building was a rectangular structure with a dome located on each of the south corners of the building. Connie drafted up the blueprints and Steve constructed a model of the observatory, and the JCCB accepted this design proposal.

Tile Jasper County Conservation Board dove in head first and began raising the funds necessary to build the building. Donations came from the Jasper County Conservation Board, the Fred Maytag II Family Foundation, Pioneer Hi-Bred International, Inc., the Meredith Corporation, Peter T. and Ellen Madsen (in memory of Linda Gaugh Bunn), Burton and Opal Wilson, and members of the Des Moines Astronomical Society, most notably from Keith Jamison.

The first decade of the Ashton-Wildwood Observatory was headed by Director of Observatories Larry A. Stevens. For much of the ten years the observatory committee consisted of Jim Leasure, John Sellers, Dave Lynch with Steve Sherrod dropping out and Dave Dorff taking his place. All ideas for improving the facility and changes of rules of operation was conducted by major-

DMAS members and workers from Ash Domes pose in front of a new dome

ity rule of the committee. All ideas were discussed to determine the best method, at times being refined until a nearly flawless system of operation existed. This was the concept of having a committee to facilitate the operation of the observatory.

At the time of the completion of the observatory. major benefactors of the observatory were from the Jasper County Conservation Board, the Fred Maytag II Family Foundation, Pioneer Hi-Bred International, Inc., the Meredith Corporation. Peter T. and Ellen in memory of Linda Gaugh Bunn). Burton and Opal Wilson, and members of the Des Moines Astronomical Society. Keith Jamison, long standing member of the DMAS, donated equipment in the form of a 5.5-inch Celestron Schmidt Camera, an 8-inch f/4-f/16 Cave Newtonian-Cassegrain, and a 3.25-inch f/5 Jeagers refractor. The Schmidt Camera and the 3.25-inch were mounted on the 16-inch tube, the refractor to be used as a finder.

The Ashton-Wildwood Observatory held its grand opening on 8 October 1983 with a gala display of telescopes and observing. Daytime viewing of the Sun and Venus was conducted and the viewing extended into the evening. Mark Wagner set up a special silk screen session with shirts being printed with a picture of the observatory upon it.

Public viewing sessions were set up in several segmented sections throughout the year, usually 6 to 8 weeks long and on Saturday evenings. This would not compete with the Drake Observatory Friday night evenings and would allow members to spend more time at the observatory on Saturday evenings. Occasionally, special observing sessions would be set up for things like lunar or solar eclipses, meteor showers and comet encounters, not to mention private tours for schools, scouting events or other groups.

Two of the largest events were during the lunar eclipse of 30 August 1989 with about 400 attendees, not to mention the many evenings of viewing, for Comet Hal-

Construction of Ash Domes in 1998

ley with as many as 5000 people viewing the comet from the observatory in 1985-86. In order to raise additional funds for displays and telescope parts at the observatory, Comet certificates were printed and sold for $2 each. 585 of these certificates were sold. Additionally, Halley stamps were sold for $1 each and a few sweatshirts with a special logo designed by Larry Stevens. A certificate & starnp and a representation of the sweatshirt logo is currently on display an the wall of the observatory.

The committee set up a book of rules and procedures in the use and operation of equipment at the observatory, and some of the methods such as scheduling of events were relaxed unless a tour was set up in advance.

In 1991, it was discussed that another telescope replace the 12-5-inch f/6.9 Newtonian in the east dome, on loan from Larry Stevens. In 1992, after serving as director of the observatory for 10 years, Larry Stevens stepped down. Soon his telescope was replaced with a 10-inch Meade Schmidt-Cassegrain donated by Dave Lynch.

In 1992, an article interviewing Joanne Hailey appeared in the Des Moines Register entitled "Stars Dazzle Earth-bound Gazers." The Des Moines Astronomical Society was discussed in the article.

1993 was the year for observing and celebration: On October 12, 1993, Harry Wood spotted a huge fireball from his back yard; this was also witnessed by Bryan Butcher who was in his back yard observing Saturn. Harry said it was the largest fireball he had seen in his 36 years of observing. Bryan Butcher's sketch of the fireball appears in this scrap book. On October 24, 1993, Des Moines Astronomical Society and the Ashton Observatory celebrated its ten year anniversary with an open house at the Observatory. On November 29, 1993, a wild ride was taken by Dale Gibson, Bryan Butcher and Joanne Hailey to observe the Lunar Eclipse. It was cloudy at Ashton so Bryan, Dale and Joanne headed south down I-35; we won't say how fast Bryan was driving, and at the New Virginia exit, Highway 207 Dale yelled, "I see the moon." Bryan took the exit and the three watched the eclipse from a lonely gravel road. It was fun!!!! Thanks Bryan for driving!!!!

In July 1994 a disagreement occurred in the club and the newly elected officers resigned and formed a new club. In November of 1994 Joanne Hailey travelled south with Larry Stevens, former club member, to view the total solar eclipse from Iguacu Falls, Brazil. This was Joanne's first eclipse and her first exposure to the wonders of the southern skies and it was awesome!!! See Joanne's story in the scrap book.

Giving members an opportunity to talk about their memories and insights into why The Des Moines Astronomical Society provided to them moments of excitement and moments of challenge. 1998 was a huge year for DMAS, and dedicating the new domes was a great way to finish off what was by far one of the most memorable in recent club history.

In 1996, our first theft occurred at the observatory. Over $3,000 worth of equipment was stolen. Much help was offered by the public and the police to determine how this happened and who did it.

1997 was the year for COMET HALE-BOPP'.!! In April of 1997 Des Moines Astronomical Society members hosted the Comet Hale-Bopp Marathon and over 1,200 people came and viewed the comet. Joanne Hailey and her fund raising committee raised $35,000 to purchase new Ash Domes. Allen Beers had a photograph of Comet Hale-Bopp over Ashton Domes appear on the cover of "Modern Astronomer", an English Magazine.

In May of 1998, after only 7 months to plan it, Des Moines Astronomical Society Members hosted the North Central Regional Astronomical Convention at the Adventureland Inn. This was a huge success and made a profit for the region. On September 22nd of 1998, our new Ash Domes arrived along with three men from Ash Domes to help install them. This was a great exciting event and many members helped to make it possible. On October 17, 1998, the new domes were dedicated!!!! Tom Bailey had a photograph of a Leonid Meteor streaking through a meteor trail appear on "Astronomy Picture Of The Day," and Joanne Hailey and Rose Gill along with Dale Gibson and his mom sailed to the Caribbean in February to view the total solar eclipse!!!'. All had a "rocking" good time and were able to view the eclipse from the sea. Other DMAS members who viewed the eclipse from land; Harry Wood and Family, Dave Lynch, Laurre Breman, and Herb Schwartz and family.

To be continued

Constructing a Sundial

By Stephanie Clegg

Since the earliest times of Human history, the passage of time has been recognised, the major divisions being night and day, and the change of the seasons. It is not known exactly when Mankind (or Womankind!) first marked the hours in the day, but the earliest method would have been to observe and measure the length and direction of shadows. The day was neatly divided into three parts:

Morning :- marked by the rising of the sun.
Noon :- marked by the moment when the shadows were the shortest for the day.
Night :- when the sun had set.

Sundials are probably the earliest of scientific instruments. Ancient Greece and Rome had them in everyday use, to determine the passage of time, although they marked Seasonal or Unequal hours, rather than our uniform system. Sundials remained in use long after the invention of the clock, since early clocks were erratic and needed frequent correction by Sundial!

Between the 16th and 18th centuries, the study of the "Mathematical Art of Sundial Construction" was a course of study in its own right and every scholar was expected to study and understand it. Nowadays, Sundials are considered more as garden ornaments, and few people consider them as scientific instruments or even realise their Historical importance.

I undertook the task of constructing a Sundial for a GCSE Astronomy course. The first problem I encountered was the severe lack of literature on Sundials and their construction. After some searching, the staff of Donaghadee Library came up with two books: "Sundials: Their theory and construction." by A.E. Waugh, and "The Art of Sundial Construction" by P.I. Drinkwater. (Yes, it's a real name!). In the end I chose to construct my dial using the method in Patrick Moore's book "Astronomy for GCSE." The method is as follows...

Making the Dial

Take a square of any size (see Fig.1). I chose 12 inches. Divide this in two, through the line AB. A point C is then selected for the placement of the Style/Gnomon. I made this 1 inch in from the base of the dial. A line is then drawn from D through C to E. This is your 6 o'clock line. The line CG is then drawn to make angle ACG equal to your Latitude.

Depending on which atlas I used, Donaghadee could move from 54° 39 N to 54° 33 N. To avoid detailed complications, I rounded this up to 54° N, although this could lead to inaccuracies.

From F, the point above where the line AB meets the top of the square (or the 12 o'clock line) drop a line down onto the fine CG, so that the angle CHF is 90 degrees. Measure the line FH. Then mark this distance (on the line AB) from the point F towards A, making a new point J. So FH = Fl. From the point J, mark angles of 15 degrees each. 1 degree = 4 minutes of time, therefore 15 degrees = 1 hour.

When these lines miss the top of the square, a fine is drawn from J, through the corner of the square, down to the baseline or 6 o'clock line, giving the lines JK and IL.

From the points K and L, angles of 15 degrees are marked to give the rest of the hour lines round the sides of the dial. Connect a11 the lines to the point C. The dial is complete.

Method

I started by cutting a square of copper from an old boiler we had. This had to be flattened and the sharp edges smoothed. The next step was to mark out the hour lines and etch them to give permanent marks. This had to be done carefully as one slip of the etching tool could damage the face of the dial. These lines were then smoothed using very fine sandpaper and water.

The Style/Gnomon was made from 1/4 inch steel rod. This was cut/bent to an angle exactly equal to my latitude (54 degrees North). The large washer was cut in two and welded, half on each side, to the base of the dial. Two holes were then bored and countersunk and the whole thing sprayed black to make it stand out against the copper plate. The style was then placed on

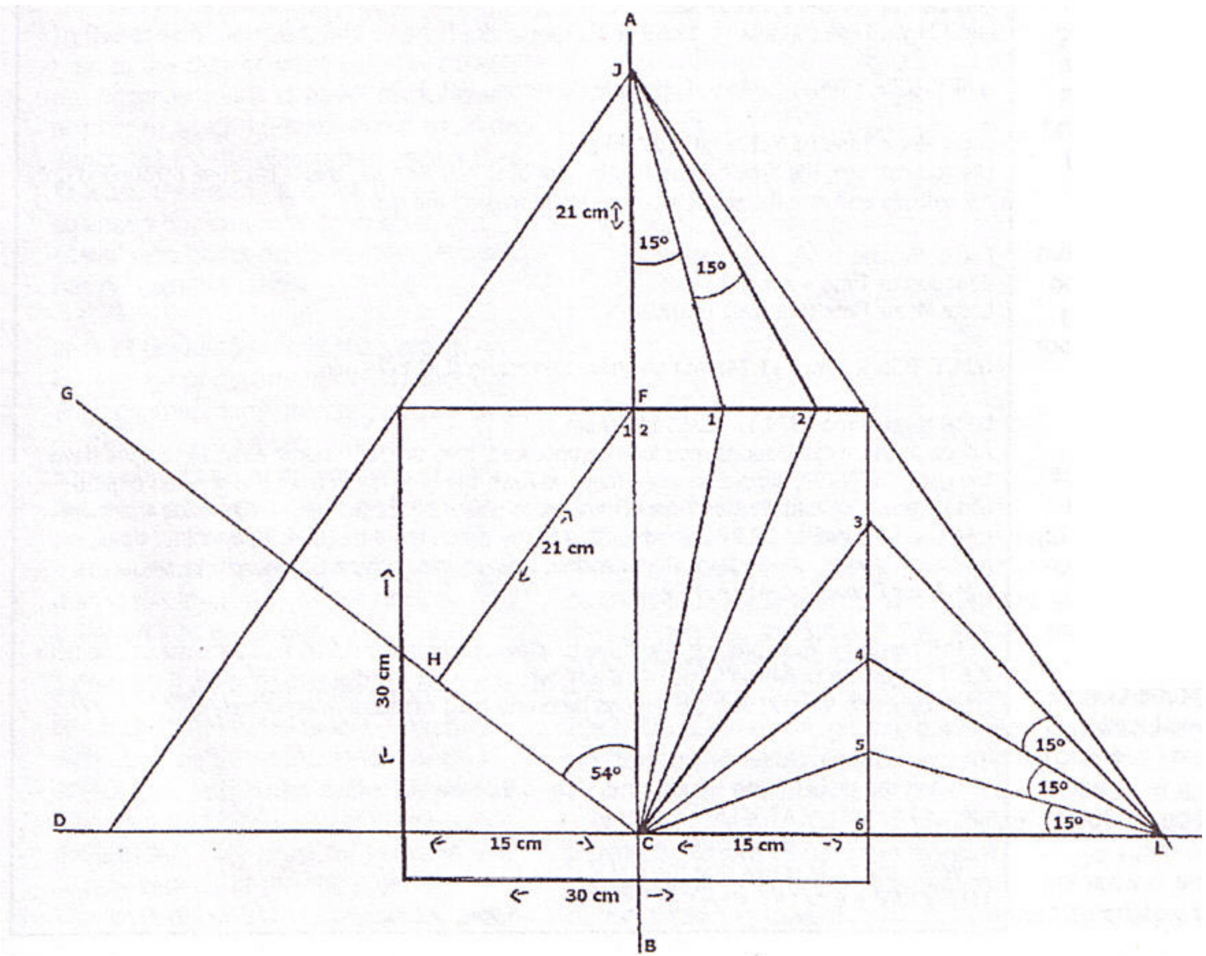


Fig.1: How to mark out the hourly positions when designing the sundial

the copper plate, with the apex of the style placed at point C, and the baseline of the style lying along the 12 o'clock line.

As copper is a soft metal, it was decided to support it by placing it on chipboard. The piece I used was approximately 15 inches square. The dial plate and style were placed on top and fixed accurately to the board via the base of the style. The copper plate was then flattened and affixed with brass tacks. The main problems encountered were:

1. the style moved very slightly when the screws were tightened and
2. the copper plate was still not perfectly flat across it's surface.

The copper plate was then polished with T-cut. This obviously dirtied parts of the chipboard surround, so the wood was sand papered to a clean, smooth surface and the hours then marked with black marker pen. The next task was to set up the dial and measure the Apparent Solar Time - the time of day according to the sun's position in the sky. For this to be accurate :

1. the angle of your style must be equal to your latitude and
2. a cloud free night and a clear view of Polaris are necessary.

This type of sundial works by aligning the style with Polaris. As the Earth seems to spin on a fixed axis, with Polaris marking the top or North fixed point, aligning the style with this fixed point means the sun will appear to move along the Ecliptic and record the Apparent Solar Time (A.S.T.) This is the time of day at your latitude given by the Actual Sun i.e. Local Noon (12 pm) on the sundial is the time the sun culminates (reaches it's highest point) on the Meridian (the imaginary line running from the North Celestial Pole through your Zenith, to the South).

A.S.T. or Local Solar Time as it is also known, differs by +4 minutes per degree East of Greenwich (ahead of Greenwich Time) and -4 minutes per degree West of

Materials Used

- 30 cm square copper plate - Etching tool
- 45 cm square section of chipboard - 12 brass tacks plus hammer
- Large washer, 2 inch diameter, 1/8 inch thick, to support style - 2 screws plus screwdriver
- Electric drill
- 1/4 inch stainless steel rod, approx. 30 cm long - Black paint
- Black marker pen
- Fine grain sandpaper - Wire wool
- T-cut and cloth
- Engineering protractor
- Pencil, ruler, protractor and paper to practice on, so I knew what I was doing before I attacked the copper plate!

Greenwich (behind Greenwich Time). Donaghadee, for example, is approximately 6 degrees W of Greenwich and 6 degrees times -4 minutes per degree = -24 minutes (this value is your longitude Correction). This means A.S.T. at my location is 24 minutes behind the time at Greenwich; i.e. when A.S.T. at Greenwich is 12 noon, the time in Donaghadee will be 11.36 am. 12pm - 24 minutes = 11h 36 min.

Mean Solar Time or Civil Time is what we have in everyday use on our watches etc. (This is only adjusted for British Summer Time). This works on the assumption that the Earth orbits the sun in a perfect circle, instead of an ellipse. As the "Mean Sun" moves at a steady rate (around the equator) the "True Sun" (which moves along the ecliptic) can be minutes ahead or behind its expected position, due to the "eccentricity" of the Earth's orbit. The difference between these two times (Apparent Solar Time and Mean Solar Time) gives us the Equation of Time, E.

Table 1: Results

DATE 27 February 1999; A.S.T. 1pm
Equation of Time -12 min 59 sec.
Local Mean Time (Sundial) 1.12.59 or 1.13pm

G.M.T. (Clock Time) 1.04pm; Longitude Correction (L.C.) -24 min.

Local Mean Time (G.M.T. - L.C.) 12.40 pm
(As you can see, the time here differs by just over half an hour, this is because I "rounded up" my latitude and also the slight inaccuracies in making the dial.)

DATE 26 June 1999; A.S.T, 10am
Equation of Time +2 min 30 sec.
Local Mean Time (Sundial) 10.02.30

G.M.T. (Clock Time) 11,24am; Longitude Correction (L.C.) -24 min.

Local Mean Time (G.M.T. - L.C.) 11.00 am
Although these calculations may look complicated, they are reasonably easy. Firstly, we have the date, 26/06/99, simple enough, then we have the time taken from the sundial; e.g. 10 o'clock am. The Equation of Time for this date was +2 min. 30 sec. which made the true L.M.T, on the dial 10.02.30 am. According to my watch the time (G.M.T.) was 11.24 am. As shown earlier, the L.C. for Donaghadee (Ireland), was 24 min. behind Greenwich, so the actual L.M.T. for Donaghadee was 11 am.

In this particular example, we also have to allow one hour for B.S.T. so 11am, minus one hour B.S.T. gives the Universal Time of 10 am. which is what my dial was showing, it was only "out" by 2 min. and 30 sec. (which can be pretty hard to measure accurately).

The two equations to remember are:
1. When the table (giving values for E.) states that the dial is fast, then

LMT = LAT - E or LAT = LMT + E

2. When the table states that the dial is slow, then

LMT = LAT + E or LAT = LMT - E

he difference reaches maximum in early November, when A.S.T. (Sundial Time) is over 16 min. ahead of

the M.S.T. (Clock Time) and the Sundial is, consequently, running "fast". In mid-February, A.S.T. is over 14 min. behind M.S.T. And the Sundial runs "slow". On four occasions during the year, April 15th, June 14th, September lst and December 25th, the Equation of Time is zero so Sundial time matches M.S.T.

Once I had the dial set up, it was simply a matter of going out to check the time. I found the best way was to record the exact hour on the sundial and then take the clock time. I then had to put these into a table for my project, but you may find it necessary to do this in order to check the accuracy of your dial. If your dial only has hour lines, the maximum "margin of error" allowed is plus or minus a half-hour either side of the correct time (A.S.T.). If you decide to opt for "segments" of 20 min. or the quarter hours, the sundial must be extremely accurate, which means no cheating like me and "rounding up" your latitude.

You can see some of the results in Table 1, which show you, roughly, how to check the dial for accuracy.

I found with my results, my dial could, at certain times, be totally accurate and at other times be out by as much as half an hour. But as my family kept telling me during this project, it's a lot easier to buy a watch!

Have fun!

Astronomy Limerick

There once was a man named Dwight,
Who's speed was much faster than light.
He went out one day,
in a relative way,
And returned on the previous night!

Some Observing Tips

A little about etiquette at star parties

The first rule is to have fun. Move around and visit all of the scopes. Pay close attention to the young astronomers. Let them show you the sky.

Be very careful with light. Use flashlights that have give off red light. Keep the car headlights off.
Keep young children under control. There is a lot of expensive hardware around for them to run into.
Sound carries well at night. I enjoy music but not everyone has the same tastes as I do, so I leave it off. Even that cosmic new age stuff can be an imposition on some people.
A key to success at any observing session is to plan on it getting colder than you might think it will be. Always dress warmly, even in the summer.

Seeing

Seeing is the ability see through the atmosphere. It has more to with the stability of the sky than the clarity of it. The night can be perfectly dear, but when you look through a telescope the image may be dancing and shimmering so much that you can hardly see anything. If you have seen a "heat wave" you have seen a cause of bad seeing. Looking over a housetop can make an image shimmer. Poor seeing is also caused by turbulent air overhead. The steadiest seeing is often when the sky has high and very thin clouds, or when there is a high pressure haze.

Dark adaptation

Many of the objects in the sky are so faint that it takes some effort to see them. It can take as much as a half hour for eyes to adjust as much as possible to darkness. It only takes a split second for a careless light to mess things up. Red filtered flashlights allow you to have enough light to see a star map without destroying dark adaptation.

Averted vision

Averted vision allows you to see very dim objects just slightly better. What you do is look a little off to the side of what ever faint object you may be looking at and you may be able to see more light coming to you. I think the reason that you are more light sensitive a little "off centre" has to do with eyeball colour receptors verses black and white receptors and how they are located in the eye. We have more black and white receptors than color and the color ones are located at the center of the retina. With averted vision, you are using those black and white ones off to the side.

The Great Astronomers

By Tim Carr

The theories and ideas of the ancient Greeks held sway for, fifteen centuries. In the early sixteenth century one man dared to challenge those views. His name was Nicholas Copernicus.

On May 24th, 1543, a Polish cleric died quietly in his rooms in Frauenburg, East Prussia. His death excited no more sorrow or comment than that of many others of the time. Shortly after his death, the one and only book he had ever written was published. It was not well received. Although some of the more liberal minded welcomed its message, most people either ignored it or denounced it as heresy. It seemed that this man's life's work would come to nothing. But in the years and centuries which followed, the central idea of that book began to take hold in people's minds. Nicholas Copernicus may have died quietly, but his life's work has echoed down through history ever since.

Nicholas Copernicus was born into a well-off family of merchants in Thorn, Poland in 1473. While still young, his father died, and young Nicholas was raised by his mother's brother, Lucas. Uncle Lucas was a stern, abrasive man, in stark contrast to his young nephew. Nevertheless, the two became very close. Recognising the obvious talent of Nicholas, his uncle, who happened to be a bishop, secured him a place at Cracow University, where Copernicus studied canon law with the intention of becoming Canon of Frauenburg.

In 1496 he travelled south to Bologna to study further. Bologna not only had one of the best universities in Europe, it also had a much more enlightened atmosphere than that at Cracow. A good example of that enlightenment was Domenico Novara, the professor of Astronomy. Novara did something very important; he infected his Polish friend with a passion for the heavens. The rest is history.

The Europe that Copernicus lived in was dominated by the science of Aristotle and the philosophy of conservative Christianity. Ptolemy said that the Earth stood still at the centre of the Universe and all celestial bodies orbited around it. Aristotle agreed with him, therefore Ptolemy was right. To be fair to the medieval Europeans it was a system that seemed to fit the facts. Eventually, however, intellectually stifled Europe began to realise that all was not well. Back in 1252, King Alfonso of Castille ordered a table of planetary positions to be drawn up. The table was to show where the planets would be according to the Ptolemaic system. By Copernicus' time, the planets were not in their predicted positions.

The rumblings of dissent began in earnest with people like Nicholas of Cusa in the early 15th century who had the effrontery to suggest that the Sun was the centre of all things, not the Earth. However, voices such as these were disparate and quiet on the whole, so the status quo remained undisturbed.

It was Copernicus, in Bologna, who questioned that status quo in some detail. Ptolemy's system had all bodies revolving in circles around the Earth. Even in ancient Greece the observations did not really fit so simple a theory, so a further refinement was added. The planets moved in a small circle called an epicycle, which itself went around the Earth in a large circle.

Copernicus knew that at least some of this theory could

not be we. For one thing, some of the planets seemed to move West to East at times, rather than always East to West; for another, Mercury and Venus always appeared close to the Sun for no apparent reason. The extra motions that Ptolemy introduced to account for this behaviour were nothing short of tortuous. There was also the precession of the Equinoxes (the 27,000 year `wobble' of the Earth's axis) which meant that the position of the Pole Star slowly moved around the sky.

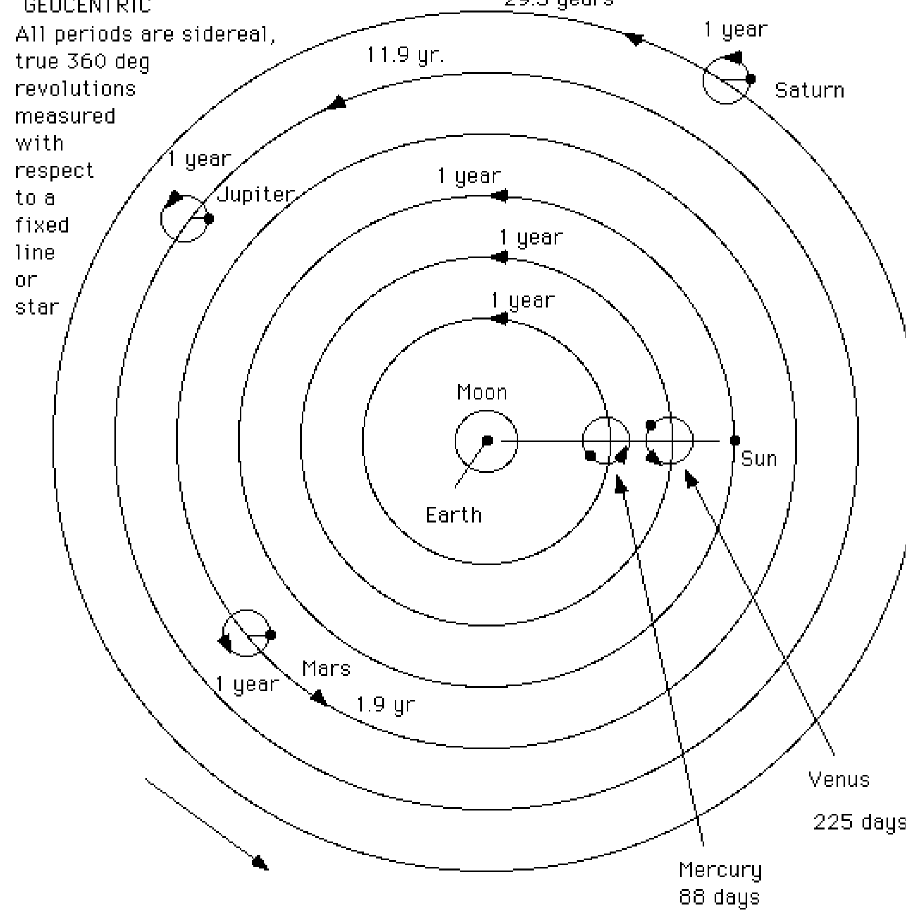
Instead of throwing out the whole cumbersome system, Copernicus actually retained much of it. He kept the perfectly circular orbits and the epicycles. He changed only one thing. However, it turned out to be the most important thing that anyone had said in science for fifteen centuries. The Earth was not the centre of the Universe, the Sun was!

Copernicus was not a publicity seeker. He had few close friends, and seemed to be fond of the frugal life. Despite the fact that perfectly good astronomical instruments were easily available, he preferred to use his own ones which were crude even by medieval standards. His reluctance to pay good money for good equipment was probably due to the fact that he would have had little use for them. The fact is, Nicholas Copernicus did not really like looking at the sky. In thirty-two years of observing, he only made twenty-seven observations!

Sometime between 1503 and 1506, he returned to Frauenburg to take up his position as Canon and was happy to spend his time on things that had little to do with astronomy. He worked on reforming the Polish monetary system and even practiced medicine. When he died he was actually better known locally as a doctor (although he held no medical degree) than as an astronomer. But all the time his mind was free to wander the heavens, and in 1507 he finally went public.

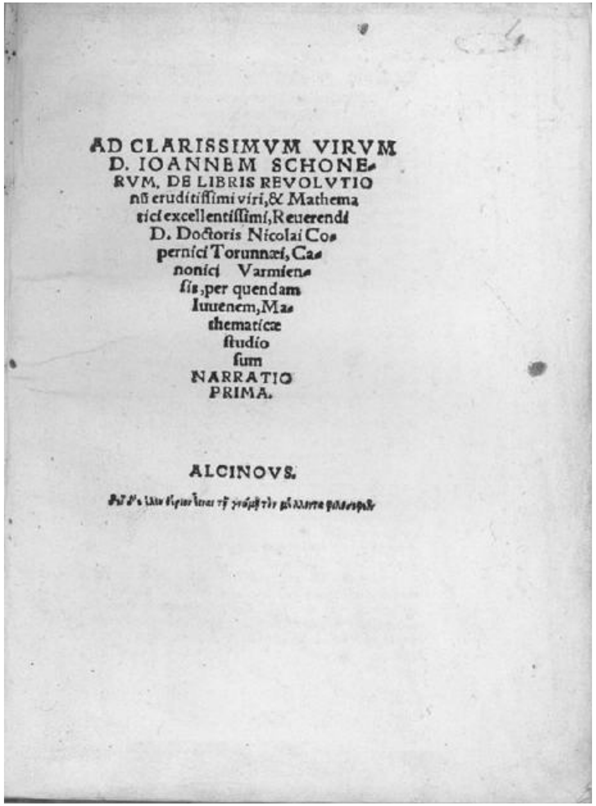
The Commentariolus (Commentary) was a twenty-page handwritten manuscript which outlined the Copernican system. His line of attack on Ptolemy was that the ancient Greeks not only said that planetary motion was perfectly circular, -but was at a uniform speed. The Ptolemaic system did not allow uniform speed. The new system did, as long as a few basic principles were accepted. There were seven in all. The basic tenet of these was that the Sun was at the centre of the Universe, with the Earth only at the centre of the Moon's orbit; all heavenly bodies did not orbit the same centre; the stars were much farther away than anything else; and the apparent motion of the sky is actually caused by the motion of the Earth; the Sun's annual motion (and the retrograde or backward movement of some planets) was due to the fact that the Earth orbited the Sun.

PTOLEMAIC MODEL
GEOCENTRIC



Direction of Revolution toward east, counterclockwise as seen from above the north pole.

Claudius Ptolemy (ca. 100 - 170 A. D.), Alexandria. Published synthesis of greek astronomy in the ``Almagest''.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Narratio Prima Excusum Gedani, (1540). The first illustrated account of Nicolaus Copernicus' heliocentric theory

The few people who read the manuscript liked it, but essentially it went unnoticed, and Copernicus would probably have been content to leave things as they were. He had his medicine, his canonical work; he even found time to act as a diplomat for the Poles in one of their interminable wars with the Teutonic Knights of Prussia.

And so it is at this stage that one of those unsung heroes of science enters the scene. George von Lauchen, known as Rheticus, was a fairly important mathematician in his own right, but his importance to us is the fact that he became a close friend of Copernicus. Rheticus had become a convert to the Sun-centred theory early in his life, and decided to spread the word. Getting Copernicus to publish his theory properly would, however, be no easy task.

The common perception is that Copernicus was afraid of being burned at the stake for what he was saying. After all, it was contrary to the teachings of the church to say that the Earth was not at the centre of the Universe. But this was Europe before the 30 Years War. In this Europe it was still possible to say what you wanted, as long as you were subtle, and duly deferential to the authorities. It wasn't so much what you said as the way you said it. Copernicus did not fear persecution. He feared ridicule. This is the key to his personality. As well as his reluctance to publish his theory, Copernicus was afraid of being laughed at, afraid of being misunderstood.

Two years after they met, Rheticus published his own version of the Commentary, called `Narratio Prima'. At last, the Copernican theory was actually published for all to see. With the publication of the Narratio Prima, Copernicus now had no reason to keep silent any longer. Rheticus was the obvious man to oversee the preparation and publication of such a major work. Unfortunately, he was unable to complete the job, and it fell to Andreas Osiander to finish it. Osiander was a Lutheran however, and as Martin Luther was strongly opposed to the Copernican theory, he decided to add his own preface to the book before it was published.

The preface said, in essence, that the theory was not necessarily to be taken literally, but was rather a kind of convenient fiction, or pretence, if you like. In other words, when Copernicus says that the Earth goes around the Sun, don't worry folks, he doesn't actually mean it.

But, of course, Copernicus did mean it. The preface, which neither Rheticus nor Copernicus wanted, may have made the book more palatable to die-hard conservatives, but it did little for Copernicus' reputation among the more liberal thinkers. For a long time, people did not know whether to take the book's contents seriously or not.

The book '*On the Revolutions of the Heavenly Bodies*' was finally published in 1543. A year earlier it's author had suffered a stroke, and legend has it that he was handed a copy on his deathbed. Even if it is true, by that time he was in no condition to know anything about it. For such a hugely influential work, it has remained extremely unpopular. Only five editions were ever published, the last in 1873. As a piece of literature it is less than exciting, and when published it was generally greeted with polite indifference or else disdain.

But gradually, people began to realise the profound importance of what it contained. Like `The Origin of Species' or `Das Capita', it was one of those books that radically changed history. The vice-like grip of the ancients was now just a little bit looser. The long, dark night of the scientific soul was, if not over, then at least, drawing to a close. In the centuries to follow, Kepler, Tycho, Galileo and Newton would build on the work of the obscure Canon of Frauenburg; they would use it to fashion a new way of looking at the Universe.

A new kind of world was about to dawn.

Showcase

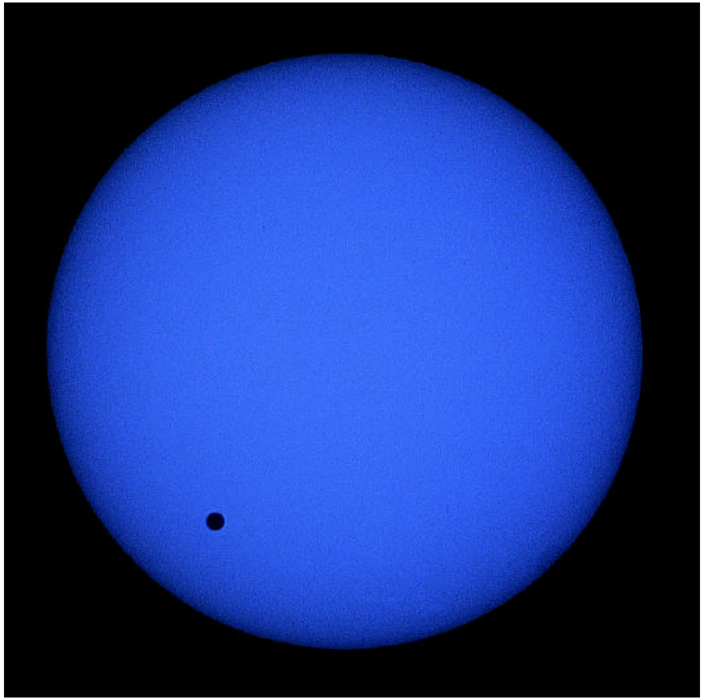
If you have images/photos, please consider sending them in to us.

Cover Picture: The Pleiades (M45). Kodak Ektachrome Elite 200 ISO slide film. Five 10-minute photos scanned and stacked in PhotoShop.
Photo: © Gary Nugent

Right: "pinhole camera effect" images of an eclipse through the trees onto a garage door. © Ken Smith

Bottom Left: Venus Transit, 8 June, 2004 taken at Saint-Chaptes, (Gard, France), with a Celestron 8” telescope, equipped with a Baader astrosolar filterr, using Ekta 100 slide film, with a exposure of 1/250 s.
© Jean-Michel Faidit.

Bottom Left: Milky Way bulge. CCD image with an SBIG ST-8 using a 50mm Nikon f/1.8 lens @ f/5, piggybacked on a Meade LX50. 30 1-min. unguided exposures stacked. Taken July 10, 2004. ©Paul Gardner, University of Central Florida.



Submissions

We're looking for submissions for the next and future issues, whatever part of the world you live in.

Issues 1 and 2 should give you a flavor for the kind of articles we're looking for. Tell us about any astronomical trips you've been on, whether they're to local or national Star Parties or vacations based around an astronomical event such as a solar eclipse. Give us warts-and -all reviews of equipment you own, from a lowly pair of binoculars, to eyepieces to large expensive telescopes. Let us know what you think of recent books on astronomy or your appraisals of astronomy software, whether they're freeware, shareware or commercial applications; profile your club or society; tell us about any equipment you've built or modified; tell us about your experiences with astrophotography and send us some of your results. We will be paying for any material used in future issues.

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